RR JXH

INTERNATIONAL SOCIAL SCIENCE BULLETIN

Mathematics and the Social Sciences

VOL. VI, No. 4, 1954
PUBLISHED QUARTERLY
PRICE: $1.00; 6/-; 300 fr.

By mutual agreement, the *INTERNATIONAL SOCIAL SCIENCE BULLETIN* will serve as the official publisher of the proceedings and some other materials of each of the following international organizations:

The International Committee of Comparative Law

The International Committee for Documentation in the Social Sciences

The International Economic Association

The International Political Science Association

The International Sociological Association

The International Studies Conference

The Provisional International Social Science Council

The World Association of Public Opinion Research (WAPOR)

RECENT ISSUES:

Vol. V, No. 3: Public Opinion Research.

Vol. V, No. 4: Documents relating to the Middle East

Vol. VI, No. 1: Second World Congress of Sociology, Liège 1953.

Vol. VI, No. 2: Factors of Economic Progress.

Vol. VI, No. 3: Economic Motivations and Stimulations in Underdeveloped Countries.

Opinions expressed in signed articles are those of the authors and do not necessarily reflect the views of Unesco.
Permission for the free reproduction of articles appearing in this number can be obtained from the Editor.
Correspondence arising from this Bulletin should be addressed to: The Director-General, Unesco, 19 avenue Kléber, Paris-16e, and marked: Attention, Department of Social Sciences (Bulletin).

PRICE AND SUBSCRIPTION RATES

Single issue: $1.00; 6/-; 300 fr.
Yearly subscription: $3.50; 21/-; 1,000 fr.

Any of the distributors listed will be pleased to accept subscriptions; rates in currency other than the above will be supplied on application to the distributor in the country concerned. When notifying change of address please enclose last wrapper or envelope.

Printed in France.
SS. 54. I. 23 A

© Unesco 1954

INT

Introd

I. ME
Probab
On the
The R
by I
The I
A. T
The U
G.
Mathe

II. R
Activiti
Math
The W
The In
The Ca
The C

PART.

I. O
The Int
The W
Unesco'
A Surv
Unde

II. RE
Docume
Agenc
Internat
Book Re

1

UNESCO

INTERNATIONAL SOCIAL SCIENCE BULLETIN

A QUARTERLY BULLETIN PUBLISHED BY UNESCO

VOL. VI, NO. 4, 1954

TABLE OF CONTENTS

PART. I. MATHEMATICS AND THE SOCIAL SCIENCES

Introduction: The Mathematics of Man, by Cl. Lévi-Strauss. 581

I. METHODS AND RESULTS

Probability and the Social Sciences, by B. de Finetti 591
On the Mathematics of Social Communications, by C. Cherry 609
The Relevance of Mathematics to Controlled Experimentation in Sociology, by L. Festinger 622
The Role of Mathematics in Economic Prediction and Stabilization, by A. Tustin and R. C. Booton, Jr. 628
The Use of Mathematical Methods in Econometrics and Economic Statistics, by G. Tintner. 640
Mathematical Methods in Public Opinion Polls, by P. Thionet. 652

II. RESEARCH CENTRES

Activities of the Social Science Research Council (New York) relating to Mathematical Methods in Social Science, by E. Sibley. 675
The Watson Scientific Computing Laboratory, New York. 679
The Imperial College of Science and Technology, London 681
The Carnegie Institute of Technology, Pittsburgh 682
The Committee on Mathematical Biology, Chicago. 684

PART. II. ORGANIZATION IN THE SOCIAL SCIENCES; REVIEWS AND ANNOUNCEMENTS

I. ORGANIZATION IN THE SOCIAL SCIENCES

The Integration of Migrants into the Life of their Countries of Resettlement. 689
The World Population Conference, Rome, August-September 1954 . . . 697
Unesco's Pilot Survey of Social Science Terminology 701
A Survey of the International Bureau of Research on Social Change in Underdeveloped Countries. 705

II. REVIEW OF DOCUMENTS, PERIODICALS AND BOOKS

Documents and Publications of the United Nations and the Specialized Agencies. 708
International Review of Periodicals 728
Book Reviews. 742

III. ANNOUNCEMENTS

The International Committee for Social Sciences Documentation, Meeting in Geneva, September 1954 748
The Conference on Race Relations, Honolulu, July 1954 750
Carnegie Endowment for International Peace. 751
A Survey of Current Research on the Middle East. 753
Books Received 753

LIST OF CONTRIBUTORS

R. C. Booton, Jr., Dynamic Analysis and Control Laboratory and Department of Electrical Engineering of Massachusetts Institute of Technology.
C. Cherry, Imperial College, London.
L. Festinger, Laboratory for Research in Social Relations, University of Minnesota.
B. de Finetti, Istituto di Matematica Finanziaria, University of Trieste.
Cl. Lévi-Strauss, École Pratique des Hautes Études, Paris; Secretary-General, International Social Science Council.
E. Sibley, Social Science Research Council, New York.
P. Thionet, Institut National de la Statistique et des Études Économiques, Paris.
G. Tintner, Department of Economics and Statistical Laboratory, Iowa State College, Ames, Iowa.
A. Tustin, Department of Electrical Engineering, University of Birmingham.

PART I

MATHEMATICS AND THE SOCIAL SCIENCES

INTRODUCTION

THE MATHEMATICS OF MAN

CL. LÉVI-STRAUSS

When we consider the history of science, it looks as if man realized, at a very early stage, what his programme of research was to be and then, once having decided on it, took hundreds of years to acquire the means of carrying it out. In the earliest days of scientific thought, the Greek philosophers stated the problems of physics in terms of the atom, and now, two thousand five hundred years later—in a way that they probably never guessed—we are just beginning to fill in the framework which they outlined so long ago. The same might be said of the application of mathematics to the problems of mankind, for the speculations of the earliest geometers and arithmeticians were concerned with man far more than with the physical world. Pythagoras was deeply interested in the anthropological significance of numbers and figures, and Plato was much taken up with similar considerations.

In the last ten years or so these ideas, which were of such interest to the ancient world, have once more become matters of immediate practical concern; for it should be noted immediately that the developments to which this number of the *International Social Science Bulletin* hopes to make a modest contribution are by no means confined to the social sciences. They are also to be seen in the so-called sciences of man (if a distinction can in fact be made between the two groups). I would go even further, and say that the most sensational developments were perhaps first seen in the sciences of man—possibly because, at first sight, those sciences seem the most remote from any idea of exactitude and measurement, but also, in all probability, because the essentially qualitative object of their study made it impossible for them to 'tag along' behind traditional mathematics, as the social sciences have done for so long, and forced them to turn, from the outset, to certain novel and daring forms of mathematical thought.

The stages of this evolution can best be traced, and the fundamental changes it implies best appreciated, in the field of linguistics. From the standpoint with which we are concerned here, linguistics is in a very special position. It is classified as one of the sciences of man, but it is concerned with a social phenomenon, for language not only implies life in a society but is indeed the very foundation of that life. What sort of society could there be without language? It is the most perfect and most complex of those communication systems in which all social life consists and with which all the social sciences, each in its special field, are concerned.

Consequently, we may say that any revolution in linguistics is pertinent alike to the social sciences and to the sciences of man. Between 1870 and 1920, two basic ideas were introduced in this sphere—first under the influence of the Russian, Beaudoin de Courtenay, and later under that of the Swiss,

Saussure. The first was that language is made up of separate elements, or phonemes; the second, that it is possible, by linguistic analysis, to work out systems or, in other words, combinations governed by some law of cohesion, in which, as a result, changes occurring in one part necessarily entail others, that can therefore be foreseen. The story of how these principles led to the establishment of structural linguistics—through the thinking of the Russian, Trubetskoy,[1] and the work of his followers in many lands, Jakobson, Benveniste, Sapir, Bloomfield, Hjelmslev, Sommerfelt and a number of others—is a familiar one. Structural linguistics is based on the principle that the phonemes, the microscopic elements of language, are distinct and separate (an idea probably first defined by the medieval Indian grammarians), so that, in the first place, they can be identified and, in the second, the laws by which they are associated can be determined. Those laws are quite as strict as the laws of correlation found in the natural sciences.

The laboratory research conducted independently by communication engineers was to lead, round about 1940, to very similar conclusions. In the manufacture of equipment for the artificial production of speech sounds—such as the famous *Voder*, the forerunner of a whole series of more highly developed devices—and in the theoretical elaboration of the intellectual methods governing the work of communication specialists[2] certain main principles of interpretation can be seen in action, which are exactly the same as those at which linguistic theory had arrived—i.e. that communication among people is based on the combination of ordered elements; that, in each language, the possibilities of combination are governed by a group of compatibilities and incompatibilities; and lastly, that the freedom of choice in language, as defined within the limits of these rules, is subject, in time, to certain probabilities. Thus, by a memorable conjunction of circumstances, Saussure's famous distinction between language and speech coincides with the two great aspects of contemporary thought on physics, language being a matter of mechanical and structural interpretation, while speech, despite its apparent unpredictability, freedom and spontaneity (or perhaps because of them), provides a field for the calculus of probability. For the first time in the history of the sciences of man, it becomes possible, as in the natural sciences, to set up laboratory experiments and to check hypotheses by empirical means.

Saussure had also suggested a comparison between language and certain games of strategy, such as chess. This assimilation of language to a sort of combinative process, to which we have already alluded, was to make it possible to apply directly to linguistics the theory of games, as formulated in 1944 by J. von Neumann and O. Morgenstern.[3] As the title of the book itself indicates, the theory of games was enunciated by its authors as a contribution to the science of economics. This unexpected association between a so-called science of man and another branch of study which is generally considered to be a social science clearly brings out the fundamental factor of communication, on which all human relations are based. As the exchange of messages, in which linguistic communication consists, and the exchange of goods and services, which belongs to the realm of economics, now both admit of the same formal treatment, they begin to appear as phenomena of the same type.

---

[1] Trubetskoy. *Grundzüge der Phonologie.* 1939.

[2] First systematically expounded by Claude Shannon, the engineer and mathematician, in *The Mathematica Theory of Communication*, 1949.

[3] J. von Neumann and O. Morgenstern. *Theory of Games and Economic Behaviour.*

Finally, as the state of a speech system is at all times governed by the immediately preceding states, language can also be connected up with the theory of servo-mechanisms, deeply influenced by biological considerations, which has become famous under the name of cybernetics[1]. Thus, in the space of a few years, specialists in such apparently distinct fields as biology, linguistics, economics, sociology, psychology, communication engineering and mathematics have suddenly found themselves working side by side and in possession of a remarkable conceptual apparatus in which they are gradually discovering that they have a common language.

It must, incidentally, be emphasized that the course of development which has been briefly outlined above is still continuing. After the contacts made between linguists and engineers in the realm of phonology, i.e. in matters still concerned with the infra-structure of language, a new and different development is at present leading the former towards a more exact formalization of the problems of grammar and vocabulary, while the technical problems of 'translating machines' are compelling the latter to think along similar lines. Some years ago the English statistician, Yule, expounded a mathematical method for the critical study of texts.[2] Today, indeed, certain religious circles, although traditionally wary of any attempt to reduce man and his reactions to purely mechanical terms, are cheerfully employing mathematical methods as an aid to the critical study of the Bible. A recent international conference of philologists, held in England during the summer of 1954, showed the growing importance of mathematical considerations in philology, literary criticism and stylistics. And there are certain premonitory signs that the history of art and aesthetics (which incidentally has often, for some centuries past, toyed with the idea) are not altogether unlikely to embark on the same path.

When social scientists venture into mathematics, they can therefore find encouragement and cheer in the assurance that they are not alone in the risks they run. In point of fact, they are being carried forward on a great surge of development, set in motion by forces which have nothing to do with them. For, as Mr. Festinger remarks at the end of his article in this issue of the *Bulletin*, the confidence now shown by so many social scientists in mathematical methods is due not so much to the results that they themselves have secured by those methods as to the enormous assistance that mathematics has provided in other fields, and particularly in physics.

Even so, there are certain possible misunderstandings to be avoided, and it is advisable to make clear in exactly what respects the tendency to draw together, which we have been witnessing for some years past, is novel.

Social scientists were certainly aware, well before the last ten years, that a science is not really a science until it can formulate a precise chain of propositions, and that mathematics is the best means of expression for achieving this result. Psychology, economics and demography have been using mathematical reasoning for a very long time. And, though it is true that, as regards the first of these branches of study, the use of mathematics has been confined to applied and experimental psychology (and, even there, has always been subject to criticism), in the two others the effort after mathematical accuracy and the use of mathematical methods may be said to be contemporary

[1] N. Wiener. *Cybernetics, or Control and Communication in the Animal and the Machine.* 1948.
[2] G. Udny Yule. *Statistical Study of Literary Vocabulary.* 1945.

with the founding of the science and to have progressed concurrently with it. One might therefore be tempted to conclude that the only novel thing is the extension of processes which have long been in use elsewhere to new branches of study such as sociology, social psychology and anthropology; but this would show a complete misunderstanding of the revolution which is in progress.

Though, for at least fifty years (and more, in the case of economics and demography), the social sciences have had recourse to mathematics, it has always been for quantitative purposes. They were interested in measuring magnitudes which, in their respective fields, lent themselves to such treatment —size of population, economic resources, total 'wage bill', etc. When, as in psychology, the phenomena observed did not immediately appear to present quantitative features, an indirect approach was adopted and efforts were made, by means of a quantitative scale devised for the particular purposes in view, to discover distinctive variations whose qualitative aspects alone could be directly grasped—for example, the methods of expressing the various outward aspects of intelligence in numerical terms in an IQ scale. The whole effort at mathematical expression was thus brought down to two types of operations —firstly, to extract the quantitative aspects of observations and, secondly, to measure those aspects as accurately as possible.

These two purposes are entirely justified when there are indeed quantitative features in the facts observed and when what we hope to learn can be gleaned from those quantitative features. There is no doubt that the main justification for demography and economics is that they can make use of such methods. We wish to have quantitative information about the changes in the size of the population, the increase or decrease of its resources, etc., and there is no reason to suppose that, in the future, the above-mentioned sciences will not continue such studies very satisfactorily.

Even in this restricted field, however, difficulties are encountered. In order to abstract the purely quantitative content of population phenomena, demographers are obliged to oversimplify them. The population of which they speak has only a remote connexion with the real population; it consists of sexless individuals to whom the capacity for reproduction is undiscriminatingly ascribed, for to take couples into consideration would complicate the problem unduly from the outset. The demographer's societies are thus artificially homogeneous groups, and the most fundamental characteristics of their structure are ignored—so that, whenever it is possible to make an overall study of a society (as in ethnographical studies, owing to the fact that the groups usually considered are small), the real behaviour of the population bears very little resemblance to the abstract models of the demographers. These models are useful only for large-scale studies.

Economists have similar difficulties. In order to treat their subject quantitatively, they too must simplify, discount and distort their data. Even this is not always easy: in the economic studies included in this issue, the reader will find references to an exogenous factor which may, at any moment, upset the whole nature and order of magnitude of the forecasts. This exogenous factor is, indeed, everything that the economist has had to omit or discount in his treatment of the facts observed in order that he may deal with them as quantities. Moreover—and this is another aspect of the problem—the extrapolations of the economists can be founded only on long series of observations; and, as an economist himself points out in this issue (see the article by Mr. Tintner), the series at the economist's disposal are always, in some degree,

matters of history. We are thus on the horns of a dilemma; we can either extend the series (but then their components become steadily less comparable), or we can restrict them in order to preserve their homogeneity (but then the margin of uncertainty in the forecasts increases correspondingly). Any gain in significance means an equivalent loss in accuracy of measurement, and vice versa.

This brings us up against a fundamental difficulty of measurement in the social sciences and the sciences of man. There are, no doubt, many things in our fields of study which can be directly or indirectly measured; but it is by no means certain that they are the most important things. Experimental psychology has run up against this major obstacle for years; it has measured, so to speak, for all it is worth; but whereas in the physical sciences experience proved that the progress of measurement was in direct relation to that of knowledge, in psychology it was found that the things which could be measured most satisfactorily were the least important, and that the quantification of psychological phenomena was not by any means in step with the discovery of their signification. This resulted in an acute crisis for so-called 'scientific' psychology; and, as we have just seen, the same discrepancy has been found, though probably to a lesser degree, in the other branches of study which have long been seeking to achieve 'mathematical' scientific exactitude.

Must we conclude that there is such a fundamental, irreducible difference between the natural sciences on the one hand and the social sciences and sciences of man on the other that all hope of applying to these latter the rigorous methods which have wrought so much for the former must be abandoned? Such an attitude, like that of F. A. von Hayek,[1] seems to me to reveal real obscurantism, taking this term in its etymological sense which means obscuring a problem instead of clarifying it. The criticism to which the experimental psychologists of the beginning of this century, and the traditional economists and demographers, are open is certainly not that they have paid too much attention to mathematics, but rather that they have not paid enough; that they have simply borrowed quantitative methods which, even in mathematics itself, are regarded as traditional and largely outmoded, and have not realized that a new school of mathematics is coming into being and is indeed expanding enormously at the present time—a school of what might almost be called qualitative mathematics, paradoxical as the term may seem, because a rigorous treatment no longer necessarily means recourse to measurement. This new mathematics (which incidentally simply gives backing to, and expands on, earlier speculative thought) teaches us that the domain of necessity is not necessarily the same as that of quantity.

This distinction became clear to the present writer in circumstances which it may perhaps be permissible to recall in this context. When, about 1944, he gradually became convinced that the rules of marriage and descent were not fundamentally different, as rules of communication, from those prevailing in linguistics, and that it should therefore be possible to give a rigorous treatment of them, the established mathematicians whom he first approached treated him with scorn. Marriage, they told him, could not be assimilated either to addition or to multiplication (still less to subtraction or division), and it was therefore impossible to express it in mathematical terms. This went

[1] F. A. von Hayek. *Scientism and the Study of Society.* 1952.

on until the day when one of the young leaders of the new school, having considered the problem, explained that, in order to develop a theory of the rules of marriage, the mathematician had absolutely no need to reduce marriage to quantitative terms; in fact, he did not even need to know what marriage was. All he asked was, firstly, that it should be possible to reduce the marriages observed in any particular society to a finite number of categories and, secondly, that there should be definite relationships between the various categories (e.g. that there should always be the same relationship between the 'category' of a brother's marriage and the 'category' of a sister's, or between the 'category' of the parents' marriage and 'category' of the children's). From then on, all the rules of marriage in a given society can be expressed as equations and these equations can be treated by tested and reliable methods of reasoning, while the intrinsic nature of the phenomenon studied—marriage—has nothing to do with the problem and can indeed by completely unknown.[1]

Brief and simple as this example is, it is a good illustration of the direction now likely to be followed in collaboration between mathematics and the sciences of man. In the past, the great difficulty has arisen from the qualitative nature of our studies. If they were to be treated quantitatively, it was either necessary to do a certain amount of juggling with them or to simplify to an excessive degree. Today, however, there are many branches of mathematics—set theory, group theory, topology, etc.—which are concerned with establishing exact relationships between classes of individuals distinguished from one another by discontinuous values, and this very discontinuity is one of the essential characteristics of qualitative sets in relation to one another and was the feature in which their alleged 'incommensurability', 'inexpressibility', etc., consisted.

This mathematics of man—to be discovered along lines that neither mathematicians nor sociologists have as yet been able to determine exactly, and which is, no doubt, still to be elaborated to a very large extent—will, in any event, be very different from the mathematics which the social sciences once sought to use in order to express their observations in precise terms. It is resolutely determined to break away from the hopelessness of the 'great numbers'—the raft to which the social sciences, lost in an ocean of figures, have been helplessly clinging; its ultimate object is no longer to plot progressive and continuous movements in monotonous graphs. The field with which it is concerned is not that of the infinitesimal variations revealed by the analysis of vast accumulations of data. The picture it gives is, rather, that resulting from the study of small numbers and of the great changes brought about by the transition from one number to another. If the example is permissible, I would say that we are less concerned with the theoretical consequences of a 10 per cent increase in the population in a country having 50 million inhabitants than with the changes in structure occurring when a 'two-person household' becomes a 'three-person household'. Study of the possibilities and limitations connected with the number of members of very small groups (which, from this point of view, remain 'very small' even if the members themselves are groups of millions of individuals each) no doubt carries on a very old tradition, for the earliest Greek philosophers, the sages of China and India, and the thinkers of the peoples who lived in Africa and America before

[1] C. Lévi-Strauss. *Les structures élémentaires de la parenté.* 1949.

colonial times and before Columbus were all much concerned with the significance and peculiar properties of numbers. The Indo-European civilization, for instance, had a predilection for the figure 'three', while the African and Amerindian peoples tended to think in 'fours'; and the choice made had definite logical and mathematical implications.

At all events, this return to small numbers was bound to have unforeseen consequences in the field of modern thought.

It is not, of course, for us to assess the scope of the revolution in economics caused by the work of von Neumann and Morgenstern, to which we have already alluded on several occasions. But the sociologist and the historian of thought are certainly entitled to attempt to understand the general changes in mental attitudes brought about by the introduction of new views—and not only among economists. Until recent years, the work of economists was based exclusively on statistics and function analysis. They considered large numbers, and long series of variations in time and space; plotted curves from them, and endeavoured to determine correlations. Such investigations were, and quite rightly still are, very well regarded, as they make it possible to foresee or forestall certain undesirable correlations, or to perpetuate, and foster others which are considered to be desirable. To a certain extent—though people are not always agreed on how much—these speculations are useful; but they involve so much abstraction and such enormous groups of variables that, in the first place, there can never be any certainty that the suggested interpretation is the only one possible, or even the best (or indeed, in most cases, that it will produce any result); and in the second place, even on the most favourable assumption, when experience confirms the forecast in all respects, we never know quite what happens, because none of us ever encounters in real life those creations of reason with which economists habitually consort and which go by the names of marginal utility, profit-earning capacity, productivity and profit, etc.

On the other hand, when we look at the *Theory of Games*, what do we find? Firstly, no doubt, a more complicated and delicate mathematical apparatus than that found in economic or even econometric treatises. But at the same time, paradoxically enough, the things talked about are much simpler. They are no longer abstractions, but people and groups of people—generally small groups of two, three or four players, such as those made up for chess, bridge, or poker. Secondly, these players are engaged in operations which all correspond to experiences of actual life: they fight or form alliances, conspire with or against one another, co-operate or exploit each other. This, therefore, is a form of economics which aims at a very high standard of mathematical accuracy and, at the same time, resolutely concentrates on actual beings, encountered in real life, with an immediate historical and psychological significance.

When all is said and done, the specialists must decide what this new economics is worth. All I shall do is to point out that it derives from both the great schools of thought between which economics has hitherto been divided—pure, or would-be pure, economics, which is inclined to treat *homo oeconomicus* as a perfectly rational individual, and sociological and historical economics as originated by Karl Marx, which aims, primarily, at providing the dialectical apparatus for a struggle. Both these schools are represented in von Neumann's theory. For the first time, therefore, so-called bourgeois and capitalistic

economics and Marxist economics have a common language at their disposal. This does not mean, of course, that they are likely to come to an agreement; but at least they have common ground for discussion, and it is the mathematical approach which has made this surprising development possible.

A second example is furnished by social psychology, and more particularly by the work of Louis Guttman,[1] first presented in the monumental *American Soldier*, and again, very recently, in the collective work *Mathematical Thinking in the Social Sciences*.[2] When, at the beginning of the last world war, the American military authorities decided to call in social scientists on a very large scale in order to introduce a little order and clarity into the psychological and sociological problems of recruitment and selection, the investigators, at the very outset, came up against the difficulty of how to assign numerical values to the apparently heterogeneous answers to the questionnaires, so that they might be compared.

While Lazarsfeld was pursuing his investigations in an endeavour to provide an objective basis for the concept of character, founded on the notion of probability mechanisms[3] Guttman struck out on quite a different line with probably more revolutionary implications. He noted that a numerical scale could be worked out immediately in certain special cases where the questions were expressed and classified in ascending order of magnitude. In a questionnaire on stature, for instance, if I ask for an answer to the following questions: Are you over 4 ft. 11 in. tall? over 5 ft. 3 in.? over 5 ft. 7 in.? and so on, any individual who answers 'yes' to the third question must automatically answer 'yes' to the preceding questions (but not necessarily to the questions coming after). Experience shows that the numerical scales so obtained show certain remarkable features of harmony and regularity, which are immediately apparent; they thus intuitively reflect the clarity of logical and psychological structure in the corresponding questionnaires. Guttman has however succeeded in, so to speak, reversing this relationship between the social sciences and mathematics. He has shown that, even for questionnaires designed on other lines, where the psychological and logical structure is not known in advance, it is always possible to rearrange the replies so as to rediscover the ideal balance. On the other hand, the manipulations by which this has been effected make it possible to break down the original questionnaire into its logical and psychological components, so that what appears to be a purely formal approach to the results of a questionnaire in fact enables us to subject it to critical scrutiny, i.e. becomes an instrument of discovery in the social sciences themselves.

In his latest publications[4] Guttman, reverting to certain traditional problems of social psychology and, in particular, to the fundamental themes in the thinking of his great forerunners, Spearman and Thurstone, throws an entirely new light on the psychological problems dealt with in the classical tradition by factor analysis; he opens up new possibilities for the methods of selection by tests, and for the theoretical interpretation of the function and value of such tests. At the same time, and certainly not deliberately, he pro-

[1] *American Soldier*. Edited by S. A. Stouffer, 4 vols., 1949-50.
[2] Edited by P. F. Lazarsfeld, 1954.
[3] P. F. Lazarsfeld. A Conceptual Introduction to Latent Structure Analysis, *Mathematical Thinking in he Social Sciences*, 1954, chapter 7.
[4] Louis Guttman. *A New Approach to Factor Analysis: The Radex*, op. cit., 1954, chapter 6.

vides historians, sociologists and anthropologists, for the first time, with a mathematical method that can be applied to the problem of the development and classification of human cultures, and that is admirably calculated to solve the difficulties and remove the contradictions which have proved a hopeless obstacle to this type of investigation ever since the days of Condorcet and Comte.

These two examples, drawn respectively from economics and from social psychology, will—I hope—give a better idea of the scope and novelty of the upheavals which are now taking place in the social sciences and the sciences of man, under the impact of the latest trends in modern mathematical thought. The articles that follow will illustrate what has been suggested above. In order to gain an accurate idea of the situation, it will, however, be essential to supplement what they have to tell us by reading the great works mentioned in this introduction, and a few others[1] the most important of which are listed in the bibliographies given in the articles in this issue of the *Bulletin*. It is also necessary, unfortunately, to allow for two difficulties.

The enormous majority of social scientists have, even now, had a classical or empirical training. Very few of them have a mathematical background and, even if they have, it is often very elementary and very conservative. The new openings offered to the social sciences by certain aspects of contemporary mathematical thinking will therefore call for a considerable effort of adaptation on the part of the social scientists. A good example of what can be done in this direction was recently set by the Social Science Research Council of the United States of America, which, during the summer of 1953, organized a mathematics seminar for social scientists at Dartmouth College in New Hampshire. Six mathematicians gave an eight-weeks course for 42 persons on the principles of the set theory, the group theory and the calculus of probabilities.

It is to be hoped that experiments of this sort will be made more often and more generally, but we must not be blind to the fact that they are only improvisations and makeshifts. They will probably help established social scientists not to lose their footing completely in the present upheavals; but we must also think of the rising generation, which will furnish the teachers and research workers of tomorrow. At the present time, the syllabuses of higher education make no provision for their training in mathematics. If the social sciences are really to become sciences and, to put the matter in a nutshell, are still to exist twenty years hence, reforms are urgently necessary. We can be sure, even now, that in future young social scientists will need a sound, modern training in mathematics, without which they will be swept from the scientific scene. From this point of view, Unesco has a very important duty to perform. The need for a revision of syllabuses is felt in all countries; but the teachers and administrators, most of whom have had a traditional training, are intellectually ill-equipped to plan and carry out such a revision. International action by the very few specialists throughout the world who are now able to think both mathematically and sociologically, in terms of the new situation, therefore seems particularly desirable. Unesco would render the social sciences an incalculable service if it concentrated on working out a sort of theoretical model course in social science (which could subsequently be adapted to suit local circumstances), that would strike a proper balance

[1] Especially *Studies in the Scope and Method of the American Soldier*, edited by R. K. Merton and P. F. Lazarsfeld.

between the traditional contribution of those sciences and the revolutionary new offerings of mathematical research and culture.

It would, however, be wrong to suppose that the whole problem consists simply in reorganizing instruction, so as to enable social scientists to take advantage of the latest advances in mathematical thought. It is not simply, nor indeed mainly, a question of taking over methods and results from mathematics wholesale. The special needs of the social sciences, and the distinctive features of the subject of their study, necessitate a special effort of adaptation and invention on the part of mathematicians. One-way collaboration is not enough. On the one hand, mathematics will help the advance of the social sciences but, on the other, the special requirements of those sciences will open up new possibilities for mathematics. Viewed in this light, a new form of mathematics therefore has to be developed. This cross-fertilization has, for the past two years, been the main object of the Seminar on the Use of Mathematics in the Human and Social Sciences, organized at Unesco House in 1953 and 1954 under the auspices of the International Social Science Council, in which mathematicians, physicists and biologists (on the natural science side) and economists, psychologists, sociologists, historians, linguists, anthropologists and psycho-analysts (on the human and social science side) have taken part. It is still too early to assess the results of this daring experiment; but whatever shortcomings it may have had—which are only to be expected in this period of trial and error—all involved in it are unanimous in stating that they gained much from the seminar. For man suffers quite as much, in his inner life, from 'intellectual watertight compartments' as he does, in his community life, from the distrust and hostility between different groups. By working for the co-ordination of methods of thought, which cannot for ever remain entirely unrelated in the various spheres of knowledge, we are helping in the quest for an inner harmony which may be, on a different level from that with which Unesco is concerned but no less truly, the real condition for wisdom and peace.

I. *Methods and results*

PROBABILITY AND THE SOCIAL SCIENCES

BRUNO DE FINETTI

1. PROBABILITY IN MODERN THOUGHT

1. *Scientific Progress and Ethical or Social Questions*

It is beyond the scope of this paper to discuss general or philosophical problems, such as the relationship between scientific progress and questions of an ethical or social character. It seems, however, necessary to make some reference to them, if only to place in its proper setting the whole series of the specific problems we shall review, all of which have a number of different aspects.

It is common practice, nowadays, to compare the impressive scale and speed of progress in science and its technical applications with the non-existent or inadequate progress in everything that has to do with human nature and the organization of society. This proposition is a fact, plain for all to see; and it cannot be denied, as matters stand at present, that most scientific discoveries have been exploited for man's disadvantage rather than for his benefit. If on the other hand we consider the reproaches cast from various quarters upon the scientific outlook on the ground that it has erected a 'supreme value' prejudicial to the other human values, it is clear we must reject them.

In regard to the basic question, all that is necessary is to refer to what Henri Poincaré has to say on '*La morale et la science*' (Ethics and science) (*Dernières Pensées*, VIII). Even with the passage of half a century, there is nothing to add, no alteration to make, to the theory he there so clearly and successfully defended—that no interference is possible at the logical level (there can be neither agreement nor disagreement; there can be no such thing as scientific ethics or unethical science), since it would be completely impermissible 'to draw from premisses in the indicative a conclusion in the imperative'.

It is possible, of course, that there may be indirect forms of interaction; the manner of stating the problems and reasoning upon them, the way of interpreting the solutions accepted for them in a given epoch, may well more or less influence, rightly or wrongly, outlooks in all the other fields. We must dwell upon this point, albeit for the briefest possible moment—because the fact that 'probability' has become an essential factor in science has, from this aspect, altered the position, in a way that is closely connected with other aspects of the question, with which we shall have to deal.

2. *Probability and the Conception of Science*

At the time when Henri Poincaré wrote the article we have quoted, the accepted basis of science was determinism: the world was, as it were, a

perfect piece of machinery, whose regular operation was guaranteed by rigid laws. Applications of the theory of probabilities, though of tremendous range, were merely accessory, in that they were justified solely by the practical difficulty of following the elementary phenomena in their 'deterministic' course.

Since that time, the regular operations of nature have increasingly come to be interpreted as a 'statistical result' of the chance that rules the world; accordingly, the 'definitive' hypothesis of determinism is now no more than a superfluous abstraction (some would say it had been 'belied', but the term seems to me ill chosen).

From the standpoint which interests us, this is important for two kinds of reason.

Firstly, every scientific conception is in itself a creation of the 'outlook' and modifies the outlook of the time; it is therefore in itself a subject for study, that cannot be neglected by those who deal in the ethical and social sciences.

Secondly, the evolution of conceptions in the physical sciences, in the direction indicated, has brought these sciences materially closer to the ethical and social sciences—and this for two reasons, which it is well to bear in mind. The first reason is that there is no longer any difference of principle between the certainty of 'physical' facts and the uncertainty of 'human' facts; there is only a difference (sometimes immense, but always immaterial) in the extent of the *partie du hasard* ('chance' factor) to which our forecasts are subject. The second reason is the resulting disappearance of difficulties or sophisms which seemed to impose limitations on the purposes of scientific research in the ethical or social field. There was in fact a time when it seemed forbidden to press scientific analysis beyond the strict observation of facts. Such an attitude might seem justified, polemically, for the purpose of offsetting previous tendencies (dogmatic precepts or utopian lucubrations); but it doubtless went too far, by completely rejecting the possibility of using the results of scientific investigations for the purpose of modifying or transforming reality (though it was of course none of science's business to select what modification was desirable). This was strange, moreover, if only because the laws of physics were already exploited, on a wide scale, in order to attain, through their technical application, certain practical aims; not only were traditional processes of production described, but new, improved and more efficient processes were introduced.

3. *Variants in the Conception of Probability*

It would be impossible to discuss the role of probability in thought and practice without giving some explanation of the notion of probability in the light of its variants according to the different conceptions. Apart from controversial problems of a more technical nature, there are other questions which bear on the interpretation of any given problem, and to which we shall have to refer on more than one occasion in what we are going to say.

We can confine ourselves to two essential points: the notion of probability, and the interpretation of inductive reasoning. Controversy had already arisen, in past centuries, in regard to these subjects; in the present century the question has been stated more precisely—on the one hand, in accordance with an improvement in the logical postulates of modern mathematics; on the other, in connexion with the developments in thought that have led to the institution of modern mathematical statistics.

The notion of probability presents itself to the mind as an idea associated with various closely interconnected facts: our subjective judgment with regard to unestablished facts of any kind; considerations of symmetry in regard to classical problems ('equally probable chances', as in dice, lotteries, etc.); frequencies (or recurrences) revealed by statistics.

All are agreed that these three types of consideration lead, in practice, to an identical, common notion of probability; the logical and philosophical difference between the conceptions based, as a starting point, on one or other of the three above-mentioned ideas cannot, nevertheless, be circumvented, and involves a substantial degree of diversity as regards both the delimiting of the field in which theory is to be applied and the spirit in which all the problems are defined.

The first course (subjective conception) leads us to the standpoint that is broadest and most 'absolute'; it presupposes merely the fact of our estimates of probability, and the rules of logical coherence to which these must be subject. The two other courses (the 'classical' conception and the 'statistical' conception), on the other hand, presuppose something objective, existing in reality, and bearing on 'symmetrical' situations and statistical regularities; the standpoints at which we arrive do not, therefore, enable us to apply the logic of probability, except in the limited (and ill defined) circumstances in which such premisses appear to be justifiable.

We shall more than once have occasion to note, in what follows, the difference in practical significance that arises in respect of a given problem, according to whether it is stated with reference to estimates of probability reflecting the judgments of individuals as such (or else individuals supposed to be coherent in their estimates), or whether the notion of probability and the methods for its estimation are associated with a process in which the human intellect has no part.

4. *Inductive Reasoning and Inductive Behaviour*

It is in the way of stating and understanding the problem of inductive reasoning that this difference and its effects come most clearly to light. The theory of probability establishes, in fact, the way in which the knowledge of certain facts, especially facts expressed in the form of statistical data, modifies the probability of future events (according to the classic theorem of Bayes); but this cannot be applied unless it is presupposed that the initial probabilities are known. In order to remain, for example, within the classical conception, what is at issue should be 'a priori probabilities' determined on the basis of 'equally probable chance'; under this restrictive interpretation, the principle would be applicable only in rare cases, of comparatively minor interest.

In order to escape from this situation, it has been proposed, according to one point of view, that the Bayes reasoning should be considered applicable if it is conceived as a process of adjusting probabilities on the basis of experience, where the probabilities are always understood in the wide sense of personal judgments; or, according to another point of view, that any such interpretation should be abandoned, the basis being simply the half of the reasoning which gives rise to no grounds for doubt. In this way we obtain a theory of inductive behaviour (as Neyman puts it) rather than of inductive reasoning; and it is on this last standpoint that modern statistical theories are based. The question is an open one, and will be referred to at a later stage in this paper; it seems

desirable, and possible, that the two orders of ideas should in some sort be amalgamated, so as to combine the logical rigour of the first with the wealth of application that has attended the second.

II. THOUGHT AND AUTOMATA

5. *The Automaton as a Model of Man*

It has been recommended, and apparently rightly, that close attention should be paid, in the field of the social sciences, to the discussions on 'thinking machines' and on the extent to which they can reproduce developments that, when they originate from ourselves, we call 'creations of thought' and regard as a proof of intelligence. There is, of course, something that is proper to man alone and that the automaton cannot produce; but technical progress has shown that many of the functions which one would usually be inclined to attribute to thought can in fact be performed by mechanisms of electronic brains.

This can have a dual interest in connexion with a knowledge of man and of the human actions and reactions that govern social life. On the one hand, it may help us to analyse more closely those functions of our brain which the machine can perform and, possibly, to divine, by analogy, something about the brain's mechanism; on the other, we are led to pay special attention to those faculties which we are not (at least at present) in a position to transfer to an automaton and which accordingly appear to constitute what is peculiar to thought.

In this connexion there are two points affecting the subject of probability and therefore falling within the scope of the present paper.

6. *Quantity of Information*

In principle we can say, *grosso modo*, that the part of thought which can be transferred to an automaton is the part already, formally, mechanized through mathematical logic; it enables us to deduce every tautological consequence from a series of data, by the application of rules laid down in the instructions. The series of data, as well as the instructions, constitute a body of 'information' supplied to the machine; and the notion of 'quantity of information', which has been established in order to provide a yardstick in parallel cases, merits mention here, since it has, as a concept, an interest for a far wider field.

The unit of information for this purpose is the 'bit' (abbreviation of 'binary digit'), which is the quantity of information corresponding to a 'yes-no' reply (or to the choice between two signs such as 0 or 1, a dot or a line, etc.) and, more precisely, to such a choice when it serves to decide between two alternatives which have seemed equally probable. An information quantity of n 'bit' will therefore be the information obtainable with n 'yes-no' replies, as a choice between 2^n alternatives (equally probable). The qualification 'equally probable' is necessary because, as will be seen in the mathematical supplements, in the case of unequal probabilities, recourse could be had to methods whereby the various possible chances would be identified by a varying number of signs (some by more and others by less than n), in such a way that 'on the average' (having regard to the probabilities) less than n would suffice; this

average number, calculated on the basis of the rule that puts it as low as possible, is the number generally called the 'quantity of information'.

This notion plays an important part in the theory of communications and, generally speaking, in cybernetics, whose connexions with the social sciences have several times been described and are destined to develop with great advantage to both fields. In the theory of communications, however, we have a more 'mechanical' interpretation, in which the foregoing considerations are applied to the different letters of a message in a given language, rather than to the probabilities of the various cases (content of messages); but the connexion between the two is a close one. The connexion, too, with the physical notion of entropy leads to considerations of a general nature which might be of far-reaching interest, from the standpoint of concepts, to social scientists; we merely mention this in passing, as it would take too long to develop the subject here.

7. *Rules of Decision*

When inductive reasoning leads or is reduced to inductive behaviour, to a 'rule of statistical decision', it can well be entrusted to an automaton; in this sense, and even where the circumstances are complicated, it may be said that a machine can be taught how to learn by experience and behave in the way that experience dictates.

A rule of statistical decision (in a fairly general sense—based on a sequential, not 'randomized' rule) consists in the prescribing of what is to be done after any possible succession of experiments—the continuing of them in a certain specified manner, or the terminating of them and the taking of a 'final decision'.

An example will suffice to explain the matter (in a case and a form, naturally, that are very simple). A lot of a certain type of object is to be accepted or rejected after a test consisting of the examination of certain characteristics in a sample; the number of alternatives can be increased if we assume that the objects can be accepted and transmitted to different destinations, A, B ... N, whose requirements are different. The rule prescribes, for each number n, which and how many defects in the first n pieces examined dictate, either the rejection of the whole lot (decision R), or its acceptance (decision A, B ... N), or the continuance of the tests on a $n + 1$th piece (indicating—where possible if the examination can be carried out by different procedures, or on several pieces at a time, etc.—the way in which the tests should be continued).

The same point of view applies when it is a question of choosing between different hypotheses, e.g. between a certain number of models or attempted scientific explanations, with an examination of which seems most in line with observed facts. Such methods enable us to arrive at the conclusion that one of the possible explanations A, B ... N is acceptable to the exclusion of the others, or else that the matter is doubtful and that a greater number of observations are required before a decision can be taken.

It will be seen, therefore, that the application of a rule of decision is something purely formal which could well be entrusted to an automaton; but what are we to say of the reasonings on which the rule is based and which have dictated its selection? This raises once more the 'conceptual' questions already mentioned (see Section 4).

8. *The Different Approaches*

According to the subjective conception, which involves the 'classic' reasoning system of Bayes, the essence of the procedure is that we attribute to hypotheses A, B ... N (before examination of the statistical data S) a certain degree of likelihood, of reliability, which is (according to this point of view) their probability; these degrees of reliability are then modified in the light of a knowledge of a series of data S, because every hypothesis gains or loses in likelihood, compared with any other, in the proportion that it is a 'better explanation' of the series of facts successively observed (data S) (that is, according as a higher probability was initially attributed to it).

In order to reduce such a concept to a recipe or formula for automata, which can engage in deduction and apply rules but not create the degrees of reliability that are the starting point, we endeavour, in mathematical statistics, to refer only to the second half of the reasoning. Standards are created for accepting or rejecting a given hypothesis A according to whether the facts are sufficiently in its favour or against it (in the sense previously stated); we then arrive at the position most distant from the earlier point of view. However, even among authorities who uphold that point of view, some maintain that it is not correct simply to ask whether a series of facts S confirms or contradicts a given hypothesis A, but that what should be asked is solely whether such series of facts confirms hypothesis A as against another, B (or several others, B, C ... N).

If the problem is confined within the framework of these concepts, we may justly say that, if one or other rule of decision is applied, the possible margin of error in no case exceeds pre-established limits, and it is on this principle that the usual statistical methods are based. What these methods do not take into account is the degree of probability that a decision, once taken, may be wrong; but the conflict in principle is not overmaterial in practice, because the very fact of including a given hypothesis among those to be considered is tantamount to admitting that it is not regarded as so unlikely as to merit rejection, even though such agreement as it might have with the facts was held to be purely accidental.

Moreover, Wald's researches have demonstrated the privileged position of what, even if they be regarded simply as rules of decision, may be interpreted as applications of Bayes' point of view; in this way, reconciliation of the different standpoints, which on the 'conceptual' plane was suggested by the considerations we have mentioned above, is facilitated on the technical plane as well. The connexion between this question and the problem of collective decisions will appear hereafter (see Section 16).

In conclusion, it may be said that, while it is impossible to conceive of inductive reasoning as something which, in all its processes, can be demanded of an automaton, it is enough to shear it of but little in order that this 'ultimate' idea shall correspond to a correct defining of the problem. The 'little' is, however, an essential factor from the logical point of view.

III. PROBABILITY AND THE PROBLEMS OF THE SOCIAL SCIENCES

9. *Applications of Statistics, and the Social Sciences*

Since, despite the divergencies of interpretation mentioned above, applications of statistics are always, in one way or another, applications of the calculus of probabilities, we could mention here, almost in their entirety, the ever-increasing forms in which statistics are applied—for they always have, directly or indirectly, some feature that makes them of more or less immediate interest to social scientists.

Interest may reside, firstly, in applications such as methods of checking, i.e. controlling, production and tests; applications in traffic or communication problems (telephone exchanges and such like); and many others connected with aspects of the organization of production and society that, because of their subject matter, are interesting.

Secondly, and more directly, interest resides in applications of statistical methods that are designed to establish conclusions or assemble facts of importance for the social sciences themselves—methods which, in the various fields (from psychology to economics, and from medicine to politics), make it possible either to estimate the reliability of a conclusion based on a knowledge of certain data, or to make the best plans for the collection of data ('design of the experiment') when one is free to organize it for the purpose of a given type of research. One has only to think, for example, of the vast field of investigation carried out through soundings or samplings, involving problems connected with the choice (random, or by social stratification, etc.) of the sample, and specific problems associated with each subfield of investigation for which the procedure is, or can be, advantageously employed. To mention but one single problem of a general nature, which arises in a disconcertingly fluid form in all practical application of the social sciences, we may refer to the analysis of the influence which may be exerted on given facts by a wealth of circumstances that may appear in every form of combination.

We shall not, in the present paper, dwell upon such problems, since they are the subject of other articles in the same series.

10. *Probability and the Problems of the Social Sciences*

Instead, we shall, in what follows, touch upon that series of problems in which considerations based on probability and statistics arise, not merely in their capacity as instruments designed to contribute towards a knowledge of facts, but also, and above all, as basic elements in the further development of theory or doctrine.

The social sciences in general, and economics in particular (since it is in the latter that the quantitative instruments of mathematics are to the greatest extent employed), have, with the introduction of 'probabilistic' concepts, undergone a transformation similar to that described in Section 2 with regard to the physical sciences.

In the application of mathematics to the social sciences, the idea was likewise at first followed of evolving schemata based on the 'determinism' of contemporary physics (as will be noted in Section 11); but probability has contributed, in a thousand ways, to the recasting of definitions which has been proceeding now for some tens of years, in particular: by introducing chance

into economics; by introducing the factor of the attitude of individuals in the face of risks; by promoting more adequate formulae for discussions of the result of decisions taken separately or jointly by different individuals (theory of committee decisions, theory of games, analysis of standards of choice for a community).

11. *The Classical Theory of Economic Equilibrium and its Value*

The classical theory which has sought to extend the standpoint of 'determinist' machinery to the field of economics, where its extensions have been formulated in a way that, mathematically speaking, is fairly well developed, and to the field of sociology, where the analogies have been applied in what is naturally a freer manner, has probably reached its apogee in the work of Vilfredo Pareto.

This theory has lost none of its value, even though only a part of it is still acceptable—a part which will remain the basis of any subsequent theory, even though its extensions in other directions depart from its original lines.

What remains valid in it is, first of all, the concept, there expressed for the first time, of coming back from a study of the 'global phenomenon' of economics to an analysis of the circumstances of the balance between the tastes of each single individual of whom the community under consideration consists; and secondly, but above all, the fact of having indicated, as a basic criterion for such study, the notion of 'optimum'—of a situation, that is, permitting of no possible modification which is of advantage to all the individuals affected by such modification, or, in other words, of a situation from which it is impossible to depart without prejudicing at least one individual.

The mathematical conditions governing points of 'optimum' are substantially those governing problems of 'conditioned maxima'; they are expressed through the equality of relations between partial derivatives, and can be interpreted as an equality of marginal utilities—as is well known. This is undoubtedly true from what can be called the 'geometrical' standpoint, or at any rate until an attempt is made to describe what situations 'optimum' situations are.

In mechanics a point of maximum is a point of equilibrium, and it has been endeavoured to 'transfer' the conclusion by saying that the equilibrium, under given conditions, would spontaneously become a point of 'optimum'. But here the analogy breaks down, and such a conclusion appears unjustified. The objection is often advanced against Pareto's theory that it is inadequate because it is valid only in static and not in dynamic conditions; it would seem truer to say that it gives a description of an 'optimum' situation which, as a description, is valid in all cases (static and dynamic), but that it cannot state that one of those situations will materialize automatically (whether in static or in non-static cases). Further, there are an infinity of 'optimum' situations (they amount, actually, to ∞^{n-1}, if the individuals are n); even if the above-mentioned conclusion was correct, it would not be adequate from the social point of view (because the 'optimum' situations also include those postulating the complete satisfaction of one single individual and the suppression of all the others; the strictly technical meaning of 'optimum' does not, therefore, correspond to anything immediately acceptable under such a name from a realistic and social point of view).

12. *Risk and the Attitude with respect to it*

The existence of risks (and here we refer, above all, to 'external' risks, e.g. those to which crops are exposed by the climate) complicates and enlivens the picture of economic phenomena, supplying, for example, one form of possible explanation for theories such as those bearing on economic fluctuations; it is enough merely to register this fact, for the subject is one of macroscopic proportions, which have no direct bearing on the behaviour of individuals and on the problems to which such behaviour gives rise.

The existence of risks, whether or not they are of external origin, at once raises, however, fundamental problems concerning both the behaviour of individuals in regard to them, and the effect of such an attitude on the economy.

Taking as a basis the fundamental concept of the calculus of probabilities—that of 'fair bets'—it might at first sight be thought that, faced with a situation involving a risk, a 'reasonable' individual should behave on the basis of the mathematical expectation of winning; this idea however would represent an oversimplification, since different circumstances, including a taste for or a fear of risk, may lead to different attitudes (apart from differences in the assessment of probabilities, which in nearly all such cases is only of significance in connexion with subjective definition).

The investigation's terms of reference must hence be extended, and here we meet with two different tendencies. The first involves expanding the criterion of 'mathematical expectation' so as to make it cover a whole series of behaviours or attitudes which reflect a given standard of 'reasonableness'; the second involves examining practical behaviours or attitudes in all their possible range of variety and contradictoriness.

The first point of view, originally put forward by Daniele Bernoulli (definition of 'moral expectation') and with von Neumann, Morgenstern, Marschak, Savage, etc., as its principal exponents, leads to the definition of a scale of measurable 'utilities', after which it can be said that it leads back to the criterion of mathematical expectation as applied, however, to utilities rather than to monetary values. This leads, implicitly, to the principle on which the definition of 'utility' is based: the differences in utility between A and C and between C and B are reckoned equal (for a given individual) if he is indifferent to the choice between the possession of C and of a lottery ticket which entitles him to A or B with equal degrees of probability (half and half).

This point of view, despite the wide measure of arbitrariness left to individuals in the choice of the 'utility' function, subjects them to the rules of coherence, though these will not always, in practice, be respected; the theory has to do with 'rational behaviour', and will take account of the fact that in practice the behaviour of individuals is not always 'rational'. The second point of view is more radical; admitting what we have just stated, it denies that the distinction between rational and non-rational behaviour is valid at all, and sees the theory of behaviour in face of risk in the simple acritical description of the behaviour of single individuals, whatever that behaviour may be.

These two types of investigation are both important, but a distinction should be drawn between their purposes. The coherence of a given type of behaviour involves certain more or less specifically logical requirements, and it is important to know what it means for an individual to conform to them. This does not imply denying that the actual behaviour of many individuals may betray incoherencies or that these are worth studying; on the contrary,

assuming a 'reference position', albeit somewhat idealized, the value of such study is enhanced. We should not accept solely the completely agnostic point of view, whereby each attitude is regarded as a 'fact' incapable of comment or assessment, to which all considerations of coherence are foreign; this would mean admitting that each individual regarded himself as free, not merely to have the tastes he has, and to assess probabilities according to his own subjective judgment, but even to decide what the rules of coherence, for himself, are; and that would be too much.

13. *The Choices of Several Individuals*

From the foregoing considerations on the attitude of a single individual, we pass to the more interesting considerations affecting a group of several individuals. The typical feature of the facts of social life is that they are the outcome of the decisions of several individuals, within the framework of more or less rigidly accepted rules concerning the powers of each individual member of the group.

The theories which have attempted, in the spirit of nineteenth-century science, to reduce such facts to scientific and mathematical formulation have assumed that the notions of classical mechanics were applicable to them and have amounted to faith in an automatic equilibrium (as stated in Section 11). But the contrary is the truth: the behaviour of a single individual, dictated by more or less complex, correct or mistaken reasoning and based on personal desires and forecasts, has no analogy with the deterministic behaviour associated with the material processes of dynamics. This seems all the more so when we consider the effect of the similar behaviour of several individuals, in which case we can only speak, not of forces which can in some way be added up to yield a resultant, but of wills which can agree or conflict in every possible way and for reasons that are completely fortuitous and intangible.

The only thing we can regard as established is the 'optimum' definition in the classical theory of equilibrium, in so far as it does in fact enable us to reject any solution that is not in line with it, remembering however that it does not suffice to characterize unmistakably a single 'optimum' solution, and that attempts to render the criteria of choice more specific lead to difficult paradoxes (Section 16).

14. *The Theory of Games, in Economics and the Social Sciences*

Opinions are not unanimous on the role to which the theory of games can lay claim in economics and, more generally speaking, in the social sciences. This theory, enunciated as to some of its principles by Émile Borel and considerably developed by von Neumann and Morgenstern, is at present the subject of research by numerous authorities. Its applications in regard to the special problems of economics have not, however, convinced most specialists of the importance of its contribution to their fields of study. What is the reason for this?

First of all, we must give some idea of the standpoint from which the theory of games invites an approach to economic and social facts. Individuals are 'players', not to say gamesters or gamblers; their decisions are coups or moves which they make according to the particular strategy which each has selected,

and the aim of each is to obtain the most substantial result possible (in the shape of gain, utility or satisfaction).

The simplest case, and that indicated as a basis, is the case of two players and a 'zero-sum' (meaning that it is merely a question of dividing a certain sum between the two of them, without any production of wealth, or external resources). In this case the reply is easy: there is a solution, described as 'minimax', which tells us how much the position of each player 'is worth'; there are, for the two players, two strategies which make their mathematical expectation equal to the 'minimax' value; neither player has an interest in departing from these strategies, because if he does so it is to his disadvantage. If both players depart from them, both can naturally win or lose in regard to the 'minimax' (the winner is he who adopts an effective strategy against that of his opponent, either by a process of guessing, or by chance). Probability enters into this, since we have spoken of 'mathematical expectations'; in fact, if the result with reference to Neumann's 'minimax' solution is to be present, we must introduce, in addition, mixed strategies, consisting of a choice by lot (with given probabilities) between two or more exactly determined strategies (pure strategies).

Apart from this particular case, however, the value of the minimax principle is only a partial one, whether it be sought to base on it, continuingly and permanently, the definition of what is called 'solution' (Nash), or whether everything is made to depend on the players' greatest possible scope for manœuvre (when there are three or more of them) in virtue of the fact that any group of players can 'combine' against the others.

In such a case the notion of 'solution' assumes an aspect that is considerably less easy to explain and understand, and this is associated with the circumstance that combinations (or 'coalitions') have no stability (except, possibly, in a *sui generis* sense); in general, there is always the possibility for one individual to derive an advantage by abandoning the 'coalition' to which he belongs.

Clearly, if we look at economics or the economy (or, more generally speaking, social life) from this standpoint, we get an interpretation of them which, it seems, is more realistic but offers little hope of arriving at a position of equilibrium spontaneously achieved and mathematically determinable on the basis of initial data.

It is this impossibility that accounts for the less sanguine opinions about the role which the theory of games plays in economics. If on the other hand it is thought that this impossibility is in the nature of things, and that accordingly any more specific conclusion would be illusory and deceptive, it may well be maintained that the conclusions interest in the theory of games have a positive value, and that their restricted nature effectively indicates the extent to which economic facts are determined only by the effect of chance decisions; and that it therefore provides the means of investigating whether there are, or are not, reasons for supposing or hoping that the position which is achieved is an 'optimum'.

15. *Dependence upon the Rules of Games*

All this illustrates the possibility of studying the problems under circumstances far more broadly based than those associated with confining oneself to observing what takes place in the contemporary world (or to what has been observed in the past). It is perfectly possible to confine oneself to getting to know the

strategies which different individuals employ in a given situation; but it is also possible to discuss and compare those strategies, and to advise someone how, in his own interest, to improve them; it is even possible to judge whether the rules of the game have been well chosen, on the assumption that the object of the game is to achieve, as spontaneously as possible, a state of general prosperity and concord.

In this way we arrive at the stage of posing the problems which the classical theory had thought to be resolved by analogy with mechanics. In a less complete form (in which no account was taken of chance factors or of strategies) the problem of the relationship between the alternatives left to individuals and the possibility of their leading to an equilibrium (which may or may not be of an 'optimum' nature) had been studied, as to special cases, in the theories of monopoly, duopoly, etc., and with more general application in the theory which, by introducing the notion of 'variety of freedom' for individuals, led to a definition of 'points of attraction'. This is the terminology applied to those situations of equilibrium which are achieved when the freedom assigned to individuals is such as to compel them to damage each other in strife rather than to co-operate for the common good.

16. *Agreed Decisions*

We have given an idea of what the theory of games has to say about the effect of decisions by different individuals who are antagonistically inclined towards one another; problems also arise, however, in regard to the decisions to be taken by a group of associated individuals. In this case we assume a 'coalition' in the sense understood by the theory of games, a collective body such as the board or management of a firm, or else an assembly or government charged to interpret the common interest of the citizens represented.

The premisses for a mathematical study of the question have recently been established by various authorities, including, more particularly, Marschak and Arrow. If the problem is considered generally, a great many difficult and delicate questions might fall to be dealt with in this section, and their difficulty is increased by the paradoxes to which the established results lead. To give a few examples, how is obedience to the will of the electors to be defined or interpreted, if the electors dislike crises but their representatives fail to reach agreement with a view to avoiding them? How could the electorate be enabled to give effect to its will, if it were a question not of changing the proportions of the various tendencies or parties, but of getting all the latter to accept a change of tactics? And what should be the procedure if decisions approved by a majority are ultimately found, in some respects, to be contradictory?

We are here concerned, not with questions involving the technical and always more or less artificial aspects of electoral laws and rules of assemblies, but with questions of substance, principle, and logic. It is easy to speak of the 'will of the majority', but much more difficult to attach a logically satisfactory meaning to this expression; this problem has been analysed by Arrow. To give some concrete idea of its difficulty, we may quote this example:

Let us suppose that it is a question of choosing between three possibilities, A, B, or C (electing one of three individuals, expressing a preference between three parties or three decisions, etc.), and that the electors are divided into three parts (equal or almost equal) whose order of preference, as between the three possibilities, is, respectively, as follows: A—B—C; B—C—A; C—A—B.

It emerges that about two-thirds of the electors prefer A to B and that about two-thirds prefer B to C; which would suggest that, a fortiori, the majority prefer A to C. This last proposition is, however, incorrect; about two-thirds prefer C to A (to be exact, the members of the second and third groups, while the two first-named majorities were composed, respectively, of combinations of the first and third and of the first and second groups).

It often happens that, as in this case, the application of mathematics leads to a paradox. This does not mean that mathematics should not be called upon to solve the problem; it merely means that mathematics reveals the inadequacy of the method whereby the problem can be looked at if the first stage—the analysis of the problem's meaning with mathematical aid—is omitted.

APPENDIX

MATHEMATICAL SUPPLEMENTS

Note

In the foregoing, all mathematical details have been omitted which, though necessary to some extent in explanation of the various points, would have made the paper indigestible reading for those who are not at home with mathematical formulae or who merely wish to acquire an idea of the principle. In what follows, we have included the supplementary mathematical information designed to complete the summary explanations given in the main text.

The numbering of the various supplements corresponds to the sections of the text to which they refer.

Determinism and Probability [I, no. 2]

According to the principle of causality, certain events or facts A (causes) are necessarily followed by other events or facts B (effects).

Determinism, as understood by nineteenth-century science, is the integral affirmation of the principle of causality converted into 'differential equation' form: given a knowledge of the situation of the world at the present moment, its evolution within a following short period of time will also be known (i.e. will be determined), and so on into the future. More exactly, the word 'situation' should be taken to mean 'position and velocity', which is equivalent to 'positions at two instants'; attenuating the concept, one can also speak of determinism if the future is considered fully determined on the basis of something more being known as to the past (e.g. positions at n instants, or during a complete interval of time, or throughout the past as a whole).

Within this framework, probability cannot enter into the expression of physical or natural laws; it merely plays an auxiliary role by application to those cases where the future (though theoretically 'determined' by the circumstances of the present) cannot be foreseen owing to inadequate knowledge of these circumstances.

In contrast with this conception, many 'natural laws' are now 'explained' as statistical regularities, and the development of natural facts or events is interpreted by stochastic rather than deterministic processes. The following is

an example of a natural law interpreted statistically: the equality of pressure of a gas on different parts of the wall enclosing it is an effect of the circumstance which sends an approximately equal number of molecules against those parts of the wall. An example of the stochastic process is as follows: diffusion (e.g. of heat) reducible to the framework of a 'random walk' in which the direction of each step is decided by the drawing of lots.

Under such systems the future is always undetermined, or 'free', even if the entire past is completely known.[1]

Definitions of Probability [I, no. 3]

Classical concept: applicable only where it is possible to enumerate 'possible chances' having a 'symmetrical' conformation. For example, if one throws two dice one has 36 possible combinations of the two upward faces; given that the total of 4 can be obtained in three ways (three 'favourable chances': $1 + 3$, $2 + 2$, $3 + 1$), by 'definition' the probability is 3 to 36 = 'number of favourable chances' to 'number of possible chances'.

Statistical concept: applicable solely to 'repeatable trials'. For example, if a marksman hits the middle of the target, let us say, 62 times out of a hundred, it is said, by 'definition', that his probability of success is 62 to 100 = 'statistical frequency'.

Subjective concept: applicable wherever an individual expresses confidence that an event will materialize (e.g. in sport, politics, medicine, etc.). Applicable, in particular, to both the cases mentioned above, where the probability of '3' with two dice would still be 3 to 36, not however 'by definition' or by the fact of symmetry, but 'if, and to the extent that, such symmetry causes me to regard the 36 possible chances as equally probable', and where the probability of the marksman's success at his next shot would be 62 to 100 not 'by definition' but 'assuming that I foresee a future frequency close to that observed',[2] etc. (symmetry and frequency play, that is, the same practical part, but as elements of judgment, not as elements of definition). The cases reducible to evaluation methods of this sort are, in practice, the most important so far as facilitating 'like assessments' between different individuals is concerned, but they do not differ, conceptually speaking, from each separate evaluation corresponding to a personal opinion. For example, to assess at 0.15 the probability of the victory of one competitor in a contest (sporting, artistic, etc.) means attributing to it that degree of confidence which would impel the selection of the rate of 0.15 if bets were compelled to be taken.[3]

Inductive Reasoning and Inductive Behaviour [I, no. 4]

'Inductive reasoning' is the type of reasoning based on Bayes' rule, which can be summarized as follows: the influence of experience on the assessment

[1] Such distinctions are particularly clearly described in the work by L. J. Doob, *Stochastic Processes*, New York, Wiley, 1953 (though they are not easily separable from the strictly technical part of the work).

[2] For greater precision, see section 'Inductive reasoning and inductive behaviour'.

[3] Among the numerous expositions and discussions of the various points of view, we may quote: E. Borel, 'Valeur pratique et philosophie des probabilités', vol. IV, no. 3 of *Traité du Calc. d. Prob.*, Paris, Gauthier-Villars, 1939; J. M. Keynes, *Treatise on Probability*, London, 1921; R. von Mises, *Wahrscheinlichkeit, Statistik und Wahrheit*, Vienna, Springer, 1936; and also nos. 9-10 of *Dialectica*, Zürich, 1949. For a recent succinct and general exposition of the calculus of probabilities (and statistics), see R. Fortet, *Calcul des probabilités*, Paris, CNRS (Centre national de la Recherche scientifique), 1951.

of probabilities resides solely in the cancelling of the chances excluded and the increasing of the others proportionately. If the possible chances were, initially, A_1, A_2 . . . A_n and we had assigned to their probabilities the values p_1, p_2 . . . p_n, after learning that A_{m+1} . . . A_n must be excluded and that therefore only A_1 . . . A_m must be retained, their probabilities will become kp_1, kp_2 . . . kp_m, with k such that their sum will yield 1 (whereas, before, 1 was the sum of all the p_i, for i from 1 to n).

In particular, if we wish to assess the probability of the success of a 'trial' E_{h+1} after knowing the result of the preceding h, the A are the $n = 2^{h+1}$ possible sucessions of results of the $h + 1$ trials; after knowing the results of the h first trials (which are, let us say, 00101110110100111101, a favourable result being indicated by 1 and an unfavourable one by 0), only two possible chances remain (the above-mentioned succession followed by a 1, and the same succession followed by an 0); if p_i and p_j are the probabilities initially assigned to these two successions, the probability of success of the last trial, after the result of the previous trial is known, is p_i to $(p_i + p_j)$. Under circumstances which are often natural, this value is shown to be close to the observed frequency (percentage of the 1 figures; in the example given, 13 to 21), and this is the real justification for assessments of probability that are based on frequency, according to this point of view.

Apart from this justification, there is an 'inductive behaviour', consisting in the accepting, as 'true', of a certain 'hypothesis' after a certain number of observations. The theories which aim to leave out of consideration the conceptual presuppositions of the inductive reasoning described above have, as their purpose, the describing and studying of an 'inductive behaviour' as such. In certain special circumstances (e.g. if the trials consist of drawings from an urn of unknown composition) one may then proceed according to the following concept: what is the probability that inductive behaviour, or an inductive attitude, may lead to a wrong conclusion (regarding the composition of the urn)?[1]

Rules of Decision [I, nos. 4 and 7]

The development of a theory of statistical decisions on these bases has, however, resulted in bringing together the standpoints that initially seemed to conflict. Wald's researches—it is enough to quote his two volumes *Sequential Analysis* and *Statistical Decision Functions* (New York, Wiley, 1947 and 1950)—have re-established Bayes' solutions in a privileged position, and the process of 'bringing together' has gone even further with the more recent work by Blackwell and Girshick, *Theory of Games and Statistical Decisions*, New York, Wiley, 1954. The possible connexion with the theory of games (to which we advert in no. 14) has also been investigated by Wald; it consists in regarding the statistician who selects which observations to make and which decisions to take as a 'player' who has, as his opponent, 'nature'.

On Electronic Computers [II, no. 5]

Electronic computers are not merely calculating machines of unimaginable velocity; what accounts for their being called 'electronic brains', 'thinking

[1] For this last standpoint, maintained in particular by R. A. Fisher and J. Neyman, see for example J. Neyman, *Foundation of the General Theory of Statistical Estimation, Congrès Int. Phil. Sci.*, Paris, ASI 1146, Hermann, 1951, and the inquiry carried out by R. M. Frechet, International Statistical Institute, Washington, 1947.

machines', etc., is the fact that they can automatically perform an entire complex programme of operations that varies, or may vary, in each separate case (if they could not do this, speed itself would be useless, because of the impossibility of supplying, at the same speed, the data to be worked upon). They replace, in their operations, not merely the usual machines, but the human calculator—which explains the use, in describing some of their parts, of anthropomorphic terms such as memory, the nervous system, the command and control centre, etc. (other authorities, with a preference for the prosaic, speak of 'storage' rather than of 'memory', etc.). Apart from computers, other apparatuses (especially electronic ones) performing 'human' functions have similar characteristics—that is to say, they carry out complex operations, co-ordinated with a given end in view, in a manner that the human being usually adopts by exercising his intelligence.[1]

Quantity of Information [II, no. 6]

The explanations that follow may serve to complete somewhat the summary indications given in the main text. Suppose we have to convey some information by means of a cyphered message in which two signs are adopted, e.g. 0 and 1 (we could also consider the case of messages expressed in the 10 figures of decimal numeration, or in the 26 signs of the alphabet, or again in the 36 signs-plus-figures, etc.; the only difference would be a greater degree of complication). We can form two messages with one sign, four with two signs, eight with three signs, etc. (in the last-named case we have 000,001,010,011,100, 101,110,111); in general, we can form 2^n messages with n signs. From this arithmetical standpoint, we might be led to say spontaneously, that in order to convey information about the chance that has become a reality out of 2^n possible chances, we need a message of n signs, and that the quantity of information is therefore n, if 'bit' is the unit of information (see main text).

If however we introduce considerations of probability, we see that the foregoing simple conclusion is valid only if the $N = 2^n$ chances are equally probable; in general, if their probabilities are $p_1, p_2 \ldots p_N$, the quantity of information must be defined as the sum of the terms $p_k \log p_k$ (divided by $\log 1/2$). It is easy to grasp the reason from an example, where the probabilities are all of the type $p_k = (1/2)^{g_k}$ (with $g_k = \log p_k/\log 1/2 =$ integer, and hence $p_k \log p_k/\log 1/2 = g_k\ (1/2)^{g_k}$. Suppose for example we have 16 chances, of which 4 have probability 1 to 8, 4 have probability 1 to 16, and 8 have probability 1 to 32. We could represent each chance with four signs (see above), but we can also codify the four most probable chances with three signs (000, 001, 010, 011), the four intermediately probable ones with four signs (1000, 1001, 1010, 1011) and the eight least probable ones with five signs (11000 . . . 11111). It is easy to see that this, on the average, is advantageous, because there is one probability in four of using five signs, one of using four, but two of using only three, so that on an average we need only $15/4 = 3.75$, or less than 4. This number 15/4 is in fact $\Sigma_k g_k\ (1/2)^{g_k} = \Sigma_k p_k \log p_k/\log 1/2$, and the procedure of this example is that leading to this formula, even in general cases.[2]

[1] See, for example, Colloques Int. CNRS, XXXVII, *Les machines à calculer et la pensée humaine* (Calculating machines and human thought), Paris, 1953.

[2] See, for instance, N. Wiener, *Cybernetics*, ASI 1053, Paris, Hermann, 1948, and D. Gabor's introduction to *Communication Theory*, London, Butterworth, 1953.

Equilibrium and the Optimum [III, no. 11]

Let us suppose, within the range of situation P, an index u_i (P) of the utility of P for the individual i; the situation P_1 constitutes an optimum if, within the range of possible P, there is no other situation which results in u_i (P) $> u_i$ (P_1) for all the i simultaneously. The introduction of a numerical function u_i is superfluous; it is enough to consider a relation of order,[1] however, the use of functions is more usual, and enables the conclusions to be expressed in differential form.

Thus, according to the usual hypotheses, given the possibility of exchange, the condition of optimum becomes that of equality in the ratios of desirability of two commercial articles for all the individuals who possess them.

If however positive constants λ_i are chosen, a maximum point for $f(P) = \Sigma_i \lambda_i u_i$ (P) is clearly an optimum; varying, at will, the λ (or, to put it better, their $n - 1$ mutual ratios), we obtain the ∞^{n-1} points of optimum (generally distinct, save for angularity) referred to in the main text.

These are obvious properties of 'space geometry of economic situations'. They become substantial economic statements when the above-mentioned ratios of desirability are interpreted as market prices, and suppositions are advanced regarding the conditions for the automatic achieving of such a situation.

Risk and the Measurability of Utility [III, no. 12]

The standpoint associated with Bernoulli leads us to regard an attitude or behaviour as 'rational' when there is a function u (P) which operates by a process of addition, in the sense that the right to a choice, with probabilities $p_1 \ldots p_n$, between situation $P_1 \ldots P_n$ is equivalent to the right to a sure situation P if it is $u(P) = \Sigma_h p_h u(P_h)$ (or equal to the expectation of the random number u) This u would be one of the indices of utility for the individual in question—unambiguously determined (apart from origin and unit of measurement) by such condition—out of the infinite indices of utility (we may take any increasing function of one of them). Hence the connexion with the old question of the possibility, or otherwise, of establishing a privileged u, or of 'measuring utility'.

According to the non-Bernoullian point of view, laws of preferability are regarded as defined in some way, e.g. on the basis of 'mathematical expectation' and mean standard deviation of gain (or of utility, supposing that the latter can be defined), etc.; further, account is taken of accessory factors, such as a taste for play or risk, etc.[2]

Decisions of Several Individuals [III, No. 13]

The premisses for a mathematical study of the question have recently been postulated by J. Marschak; he has distinguished, above all, different degrees of

[1] See K. J. Arrow, *Social Choice and Individual Values*, New York, Wiley, 1951.

[2] See, for example, Colloques Int. CNRS, XL, *Econométrie*, Paris, 1953.

As regards 'chance' factors in the economy, in the sense indicated at the beginning of Section 12, see, e.g., T. Haavelmo, 'The Probability Approach in Econometrics', *Econometrica*, 1944. Of particular interest may, for example, be the way in which chance fluctuations can give rise to periodical oscillations; cf., for instance, M. G. Kendall, 'The Advanced Theory of Statistics', London, Griffin, vol. II (3rd ed.), 1951.

agreement between individual members of a group, and has gone deeply into the study of certain simple but instructive cases. Other questions may arise in connexion with possible differences of opinion between those associated in the forecasting ('probability' evaluation) of future events; and this brings us back to the questions bound up with statistical decisions (leading us in fact to consider, half way between the two cases in which an estimate of initial probabilities is, or is not, taken as a basis, the intermediate case in which account is taken of several different estimates, reflecting the opinions of several individuals).[1]

The Theory of Games [III, no. 14]

Let us describe, in brief, what the case of two players with a zero sum represents. Each player has the right to make, unknown to the other, a choice from $A_1, A_2 \ldots A_n$ (in the case of the first player) and from $B_1, B_2 \ldots B_n$ (in the case of the second) (e.g. odds and evens, or stone-paper-scissors in Japanese mora); if the choices are $A_r B_s$, the amount g_{rs} which the first player receives from the second (or pays to him, in the case of loss) is determined. If there is a g_{rs} greater than all the g_{rh} $(h \neq s)$ and less than all the g_{ks} $(k \neq r)$, it is clear that neither of the two players has advantage in departing from the pair of strategies which consist in the choice of A_r and of B_s (each player, if he alone did this, would lose). There would thus be a minimax with pure strategies (A_r and B_s). Generally, this does not take place; but it always happens with mixed strategies, A and B, consisting of 'chance drawings' with appropriate probabilities $a_1, a_2 \ldots a_n$ if the choice is between $A_1, A_2 \ldots A_n$ (or, in the case of the second, $b_1, b_2 \ldots b_n$ if the choice is between $B_1, B_2 \ldots B_n$).[2]

Points of Attraction [III, no. 15]

The principle is as follows. The fact that a point is one of 'optimum' is neither necessary nor sufficient for there to be spontaneous equilibrium; this depends on what decisions individuals are or are not free to take. It may be that it is to an individual's advantage to take a decision which he is free to take and which results in his departing from the optimum, thereby prejudicing (if only indirectly) other individuals. In the same way, the others will be led to take similar measures, and equilibrium can only be achieved when the mutual prejudice attains a level where no one will be able to prejudice the others further without prejudicing, at the same time, himself.

What is then obtained is the 'point of attraction', which is definable geometrically by saying that at that stage, for each individual, the lines of freedom and the lines of indifference are tangent (rather than lines we would say surfaces, or generally speaking varieties, of freedom or indifference, visualizing spaces of several dimensions; 'variety of freedom' we would describe as that which enables an individual to 'shift' in virtue of decisions which, under a given economic system, he is free to take). The points of optimum, on the

[1] On this last point, cf. B. de Finetti, *Media di decisioni e media di opinioni* (Average decisions and average opinions), Rome, International Statistical Institute, 1953.

[2] However, in order to gain even a summary idea, it is essential to peruse certain treatises, such as that of Blackwell-Girshick already quoted (nos. 4-7) or McKinsey, *Introduction to the Theory of Games*, New York, McGraw-Hill, 1952, or at least certain more popular publications (e.g. the article by G. T. Guilbaud in *Economie appliquée*, Paris, 1949).

other hand, are, as we know (Section II), those where the lines (or varieties) of indifference on the part of all individuals are tangent; there is only coincidency if the decisions which an individual is free to take affect merely himself (without it being possible to prejudice, directly or indirectly, any other individual).

ON THE MATHEMATICS OF SOCIAL COMMUNICATIONS

COLIN CHERRY, D.Sc.

APOLOGIA

The writer wishes to make it clear, at the outset, that he writes here as an amateur. If pressed, and asked why he has the impertinence to write at all in this field, he could say only: because he was invited. But he writes as a layman —and, consequently, only for his fellow laymen. There is perhaps too much trepidation today in this matter and, in certain of the borderlands between the well-established sciences, it may well pay to trespass from time to time. The study of sociology has no sharp boundaries; and today its methods are becoming ever more fluid and experimental. It is seeking for new ways, new models, new forms of analysis; it is looking over the shoulders of mathematicians, physicists and engineers; it is striving to become more exact, more objective, less reliant upon vague analogies and comparisons, and to place itself under a stricter discipline.

Apart from his general interest in applied mathematics, the writer is primarily concerned, in his daily labours, with analysis (both theoretical and experimental) of telecommunication problems—strictly an engineering field. But he has been brought into contact with colleagues from the social sciences in two ways. First, he cannot help but be aware of the social implications of his own work in telecommunication. Communication is a social activity; it links people together, as the cement of society. But the engineer, with his telephones, radio, television . . . and his technological friends in printing, in the postal services, and a lot of other communicative callings have altered the whole time-distance relationships between the individuals in societies The engineer's social impact has been immense.

As time has passed there has been a steady increase in the sheer size of 'integrated' social units—accelerating since the start of the Industrial Revolution and surging towards climax in our own generation—from villages, to towns, to city-states, to nations—until, today, to hemispheres. True there have been vast 'empires' in the past; but they were scarcely integrated socially. A modern nation is a vast complex of interdependent systems; industries, administration, distributive systems, transport, education . . . and this

complex can only be maintained with the aid of telecommunication systems. Without telephones, telegraphs and similar technological support, the modern nation-state would be unthinkable.[1]

The writer's interest in social studies has been encouraged from the other side, too; from contacts with social scientists seeking to use certain mathematical methods which have been developed primarily by telecommunication engineers. In this article, we shall be glancing at some of this work, not with any claim to presenting accounts of these methods, or even to summarize them, but rather to discuss something of their natures and to make a few general comments.

MAN, THE COMMUNICATING ANIMAL

It is now a commonplace to refer to Man as 'the communicating animal'; the evidence is all around us. His whole development, and the growth of civilization has, in the main, been dependent upon progress in a few activities—agriculture, navigation, domestication perhaps—and none has been so far reaching as development of methods of expressing, communicating and recording his knowledge. Experience then became shared and it became accumulative. Speech is universal; with a few different spoken sounds he can give utterance to almost any thought. Probably no more than 5 per cent of the world has any form of writing while only a fraction of these enjoy the advantages of a semi-phonetic script.[2]

Human speech and writing form a system of signs of unlimited flexibility, but we have many systems of signs other than language; we have gestures, greetings and conventions of conduct; we have diagrams, pictures, roadsigns, and a host of invented, or 'set-up' systems in modern life. All these systems may be described as consisting of signs and rules for using signs. At other levels, we have moral codes, where the 'signs' are perhaps 'specific situations' (ought situations) and the rules are those relevant to one's own culture. Again, we have money systems, using signs (tokens) and rules; rules relating shillings to pence, and rules relating these to goods. We could go on adding to the list indefinitely. But, although Man continually uses signs and acts according to rules, the various systems must not be considered to be alike in all respects. They all serve a communicative (that is, social) function; but they are of different natures.

Use of the terms 'signs' and 'rules' in such a context, is sometimes misunderstood. When we play a game, such as chess or football, we obey very definite rules—anyone who breaks them is 'outside the game'. But, on the other hand, the rules of language, or other communicative behaviour, are not so rigid; and a society does not have sharp boundaries. Again, when someone tells me a joke, I may laugh, without knowing the rules! No; the 'signs' and 'rules' are those described by an observer, the scientist who is studying social communication; the individuals obeying the rules need not be aware of them. And the rules of communicative behaviour are statistical, rather than determinate.

Just as a game may be considered to be nothing more than a collection of

[1] W. McDougall. *An Introduction to Social Psychology*. Methuen & Co., London (1st edition, 1908).
[2] Professor Ross, in correspondence.

rules,[1] so perhaps we may regard a society as 'the set of (statistical) rules describing it'. But, as was stressed earlier, the rules of communication, which weld individuals into societies, are not all of the same kind. Levi-Strauss,[2] for example, divides them into three levels: (a) kinship rules (people and rules of relationships); (b) economic rules (money tokens and rules relating to goods and services); (c) linguistic rules (signs and their relationships to one another, to designata,[3] and to people). However many levels, and subdivisions, are distinguished, such classification can form only a preliminary to real analysis. It is the first 'essential step in all young sciences—observation and selection of essential attributes, classification of these, followed by the building of some conceptual 'model'. The model then offers a simplified, but adequate, representation of the observed phenomenon. If the model lends itself to mathematical analysis, then the acid tests of science can be applied; the logical implications of the model can be deduced, and comparison of these with the observed behaviour of the phenomenon itself may reveal inadequacies of the model. Such is the established procedure in the exact sciences, e.g. physics; but when the observed phenomenon is society itself, this discipline is one far more easy to discuss than to execute!

MATHEMATICAL MODELS OF SOCIETY

Herbert Spencer compared societies with organisms[4]—the body social was 'like' the animal body, in certain respects. He compared the various organs of the body to various institutions in society. The head was the seat of government; the different limbs, the alimentary canal, the regulating systems, and so on represented division of labour in society. Again, he observed that animals develop from single cells, while 'as societies grow in size, they increase in structure'. The various members of a society die, yet the society remains, as the elements of the body are continually replaced; 'the changes or failures in any parts are mutually dependent', alike in both society and the body. This theme, he greatly elaborated.

Analogy is of course a valid part of scientific method; but such analogy, by itself, gets us nowhere. It merely transfers the difficulties from one field to another. No; analogy is of possible value when the methods of analysis which have been evolved in one field can be taken over into another. In the case of sociology, analogy may help if the models set up (descriptive, for example, of economic or linguistic behaviour) can be compared with those of established exact sciences. Can the mathematical methods of physics be called in to help, say?

The building of 'models', or the setting up of descriptions, most readily comes to the mind in the language of mechanics, so great has been the impact

---

[1] J. von Neumann and O. Morgenstern. *Theory of Games and Economic Behaviour.* Princeton, 1947.

[2] C. Lévi-Strauss. *Social Structure.* Wenner-Gren Foundation International Symposium on Anthropology, New York City, June 1952.

[3] By designata, here, we mean 'what is referred to by the signs' (things, actions, relationships—any attributes, real or imagined, of the outside, non-linguistic, world). The writer has found Charles Morris' *Foundations of the Theory of Signs* (*International Encyclopedia of Unified Science*, vol. I, no. 2, Univ. of Chicago Press) of great help when discussing the rules, and the function, of language. Morris distinguishes the three levels indicated here: syntax (signs and their mutual relationships); semantics (signs and their relations to designata); pragmatics (signs and their relations to users).

[4] Herbert Spencer, *The Principles of Sociology.* Williams and Norgate, London and Edinburgh, 1877, vol. I, part II, chapter 2.

of Newton. The reason is perhaps an historic one; Newton's exact methods came first, and their effects were profound.

The eighteenth century saw a great surge of popular interest in mechanisms and mechanical gadgets; numerous automata or 'robots' were built—for playing chess, for making speech, for giving musical performances, for telling fortunes. Scientific experiments still carried the air of conjuring tricks. Descartes had earlier regarded man as an automaton ('. . . nothing but a machine covered by a hat and cloak?') and this inheritance persisted. To describe something as a mechanical model was to be generally understood. During the nineteenth century, science became identified with mechanics in the minds of many people; the universe was conceived as one vast clockwork. The mathematics of electro-magnetic theory was interpreted in terms of gyroscopes; atoms were like billiard balls, with smaller billiard balls rotating around.

Physics has since shaken off this Old Man of the Sea of mechanics from its back; 'models' are now accepted as mathematical models. But common parlance still retains mechanical metaphors. For example, in social matters we may speak of 'the swing of the pendulum' (e.g. of public opinion) or refer to a leader as 'the man at the helm', as though society were a kind of ship! These are metaphors only.

When it comes to sociology itself, what mechanical models could possibly be of use? If mechanical models be discarded, what mathematical systems can be used to describe society? Unto what is society like? In the remainder of this article, a few examples will be cited of attempts to introduce models from the physical sciences; at the same time, the writer will give his opinions (necessarily amateur) concerning distinctions between social phenomena and physical phenomena which would seem to reflect upon the structure of models. Of course, we are here begging one very large question—is there any purpose in seeking to apply the methods and language of physics to social problems? Different aspects of social structures may best be suited to different types of model, in fact. Thus economic systems may best be suited to mechanical, or at least physical, model descriptions, whereas organizations involving functional relationships between individuals (businesses, trade unions, institutions) which Herbert Spencer compared to a living body may be more readily described in the language of biologists. We cannot say here, but would merely emphasize that it is an assumption to expect one type of model (e.g. mechanical) to suit all the different aspects of social structures. From time to time, in the past, this has been doubted—whether or not sociological and biological fields are in the same category as physics;[1] but with the steady separation of the models of physics, from mechanics, this question may perhaps be resolved.

At the time of Newton it must have seemed incredible to many thinking people that all the various solid bodies in the world around them, of all sizes, shapes and weights, could possibly be described in motion by simple laws. So today is not easily accepted that material as diverse as humanity is describable by laws, even statistical laws. Mechanics and physics have developed the concepts of 'time' and 'space'; but time and space in sociology become 'history' and 'geography' and we cannot generalize law and theory from one specific group of people to others. We cannot extrapolate and transplant a theory, without question.

[1] For example, the Geisteswissenschaften movement in Germany at the end of last century.

SOME ASPECTS OF METHODOLOGY

In what follows, we shall be regarding sociology as a study of different interrelated systems. Systems are large aggregates of individuals or variables. There are countless examples; nervous systems (aggregates of nerve-cells), languages (aggregates of utterances), thermodynamic systems (aggregates of particles), economic systems (aggregates of tokens, people, goods, services). . . . But the system is more than the mere aggregate, by virtue of relationships between the individuals. A closed system is one completely isolated from outside influences. The matters to be discussed now are not primarily sociological, but relate to general scientific method.

A Phenomenon and its Observer

It is usually helpful, in order to avoid confusion, to distinguish sharply between the phenomenon itself and the observer's description of it. The two are of different categories. Figure 1 shows this schematically. In linguistics itself, distinction is drawn between the spoken utterances or writings of people (actual events, the 'object-language') and descriptions of language (rules of syntax and grammar, etc., in 'meta-language'). In society very many different sets of relationships exist, and the members may or may not be aware of these; these should not be confused with the sets of rules, with which an outside observer describes the systems he sees. People may speak and write well, but without being able to recite the rules of syntax; or they may argue well, without knowledge of logical theory.

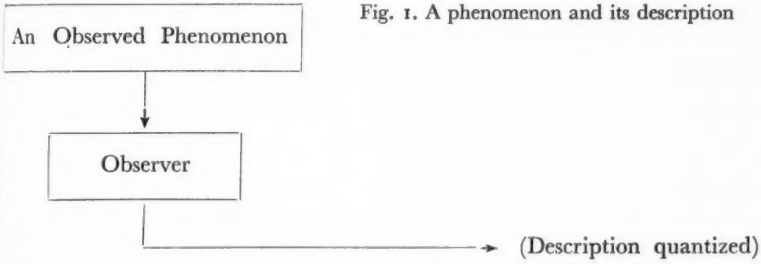


Fig. 1. A phenomenon and its description

Social phenomena are in the main distinct from those of physics in this respect. An observer may form part of, or be closely allied to, the system he is observing; he may be 'within the culture' of a social group while studying aspects of, say, its language, or its economic system. What he takes note of may wholly be coloured by his experience of the culture.

On the other hand, the members of a social group may themselves have very definite ideas as to what constitutes the 'rules' of their society—what constitutes normal behaviour; but an observer coming from outside their culture may see things very differently, and his observations may in fact include the social group member's beliefs concerning their rules.[1] Recognition of the essential coupling between a phenomenon and its observer has been well

[1] C. Lévi-Strauss, ibid.

established in physics; in sociology it would seem to be even more important, because the coupling is often a very close one.

To give an elementary example. We have all seen, on the walls of business or factory offices, flow-charts or sociograms—little blocks labelled 'Managing Director', 'Chief Engineer', 'Superintendent', etc.—showing relationships between individuals as the boss believes it to be. He may believe that orders, instructions, information . . . flow according to this pattern. But an outside observer may see the principal paths of communication flowing, not from the top downwards, but horizontally. Clerk communicates with clerk; manager with manager, foreman with foreman—as a 'class' matter.[1]

The Quantal (Discrete) Nature of Descriptions

In his description, an observer can say only a finite number of things about the phenomenon he observes. He can at best select certain attributes and describe these. For instance, if I describe a man, I can speak of his height, age, weight, complexion, girth and so on; but on no account can I convey a complete description. These attributes represent the co-ordinates of an hyper-space, attribute-space. Figure 2 shows axes of age, weight and height as a simple example.

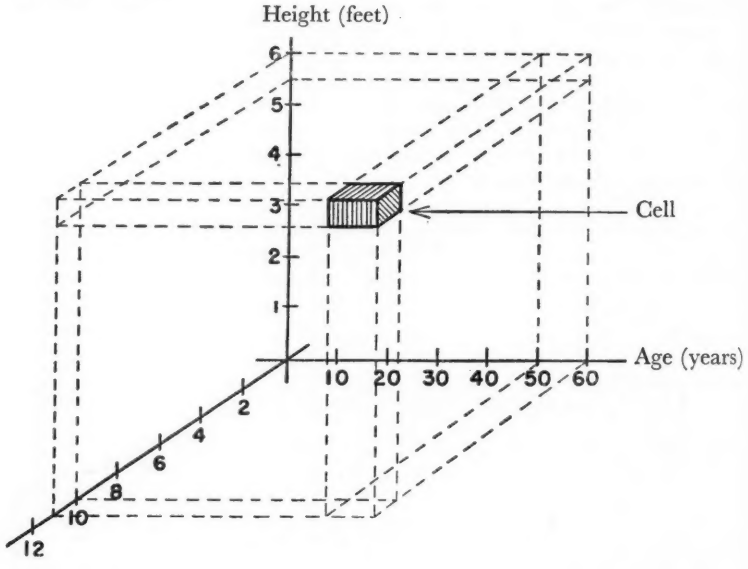


Fig. 2. A 3-dimensional 'Attribute space' for describing a man. Quantized scales of *age*, *weight*, *height* (the cell shown corresponds to age 50-60 years, weight 10-11 stone, height $5^1/_2$-6 feet)

[1] T. Burns. 'The Directions of Activity and Communication in a Departmental Executive Group', *Human Relations*, VII, no. 1; *Nature*, 14 November 1953 (letter); P. Pigors, *Effective Communication in Industry*.

Again, measurements of these attributes can be made only to a finite accuracy; a man's height may be stated as being 5 ft. 6 ins. or, with greater accuracy, 5 ft. $6^1/_4$ins.—but I cannot state his exact height.[1] Such a finite discrete, quantal, viewpoint is a logical necessity of description.[2] Measurements can be located only within quantal intervals or cells, and never located at exact points in such a space. For illustration, the 'cell' shown in Figure 2 corresponds to age 50-60 years, weight 10-11 stone, height $5\frac{1}{2}$-6 ft. A point placed anywhere within this cell represents a man whose description conforms to these attribute values. The idea of continuous functions is deeply engrained on our minds, from their long tradition in mathematics. But today this quantal aspect is receiving more and more stress. Linguistics regards description of language as necessarily quantal;[3] even mathematics is becoming more concerned with discrete quantities.

Independent and Related Attributes

When making a description, we may regard the selected attributes either as independent or related. In the case of the man described by his height, age, weight, etc., we could simply list these as independent—if we were not specifically concerned with their relationships. Then the man could be represented as a point lying inside a particular quantal cell in this attribute space, having the correct co-ordinates (Figure 2). Further, if we examined and measured all the n members of a population we could plot all their points inside their corresponding cells. The numbers of points inside the various cells, $n_1, n_2, n_3 \ldots$ would, as a fraction of the total $n = \Sigma n_r$ represent the probable distribution of these attributes. Alternatively, if we select q independent attributes, then the whole population of n members may be represented as a single point—the system point—lying inside an hyper-space of nq dimensions.

Such a model makes the assumption that the attributes are independent. The simplest model of this kind is then one requiring the fewest attributes, or dimensions, and a great deal of analysis is based upon a search for the fewest attributes which yields an adequate description. The only social field of which the writer has direct experience in this connexion is linguistics; Jakobson has proposed a system of 12 attributes of speech ('distinctive features') each quantized into two cells only, rather than the various phonemic systems at present in use.[4] Then the various speech sound elements (phonemes) of a specific language are described by placing points in the cells of this 12-dimensional space.

Where the great difficulty would seem to lie, and where real insight is required in the mathematical analysis of social systems, is in the initial selection of those fewest attributes of the system which are truly significant. With these fewest attributes, and assumptions concerning the laws relating them, a model may be built.

[1] We cannot communicate irrational numbers, like $\sqrt{2}$ or π, but only rules about them (H. Poincaré, *Science and Hypothesis*, Walter Scott Publishing Co. Ltd., London and New York, 1905).

[2] D. M. Mackay. 'Quantal Aspects of Scientific Information', *Philosophical Magazine*, no. 41, 1950, p. 289.

[3] See M. Joos, 'Description of Language Design', *Jour Acoust. Soc. America*, *22*, no. 6, 1950, p. 701.

[4] R. Jakobson, G. Fant, M. Halle. *Preliminaries to Speech Analysis*, M.I.T. Acoust. Lab. Report 13, Massachusetts Institute of Technology, Cambridge.

SOCIAL 'SYSTEMS' AND THERMODYNAMICAL SYSTEMS

The type of representation of 'systems', at which we have just briefly glanced, is suggestive of statistical mechanics—the interpretation of thermodynamics in terms of statistical description of the 'attributes' of the myriad of moving particles which constitute a gas. These attributes are the positions in space and velocities of the particles.

There have, in fact, been a number of suggestions of analogy between statistical mechanics of gases and social 'systems'; both are concerned with immense aggregate of individuals and with statistical, macroscopic properties rather than with life-histories of specified people or particles. The physicist's position bears some similarity to that of the social scientist but, as we shall see, the latter's difficulties are the greater. Common parlance again suggests an instinctive comparison here; we speak of 'economic pressures', 'political climates', etc.—but can such concepts be given the exact and unambiguous definitions possessed by the the physical concepts of pressure, temperature, entropy? A social system may be regarded in some respects as a causal system—a determinate 'machine'—describable in terms of direct interactions between various macroscopic attributes; for example, economics may be concerned with causal relations between wage-levels, prices, unemployment figures, rates of investments, etc., regarded as averages. But in other respects, a social system can only be regarded as a probabilistic 'machine' since the precise life-histories of every single individual cannot be considered. And statistical mechanics is a mathematical method which has been set up for describing systems which are partly causal and partly probabilistic.[1]

But there are difficulties and limitations, as with most analogies. In the first place, statistical mechanics is most usually related to isolated aggregates of particles in thermal equilibrium; the probabilities used remain fixed with time—that is, the systems are stationary. But many statistical properties of human populations change from year to year, or generation to generation. (However, Professor Toynbee has observed that certain populations do in fact remain in remarkable constancy of behaviour.)[2] Again, statistical mechanics is a developing subject; it is not entirely confined in application to stationary physical systems nor to loosely coupled systems of particles like gases—but also to liquids and solids where the particles have very strong interactions. So there may be hope yet.

From time to time we have seen calculations and predictions made upon the future of social structures, based upon the assumption that their statistical properties, assessed over relatively short periods of time during modern times, remain stationary—simple extrapolations forwards or backwards. One such prediction concerns the possible world population in years ahead. But such calculations, based or stationary statistics are patently false, and reminiscent of Malthus. One particular recent illustration of the effect of a single major change of social condition upon population statistics might be mentioned here. Wilhelm Fucks has investigated the manner in which birth and death rates change in different countries, during their passage from pastoral to industrial structures.[3] He shows that the birth rate decline in fact lags behind that of

[1] R. Fürth. 'The Physics of Social Equilibrium', *Advancement of Science*, VIII, no. 32, March 1952, p. 429-34.
[2] A. Toynbee. *A Study of History*. Oxford University Press, 1946.
[3] W. Fucks. 'Die Naturwissenschaft, die Technik und der Mensch', *Arbeitsgemeinschaft für Forschung des Landes Nordrhein-Westfalen 8*, p. 7

the death rate, with the result that, during the transition period, there is a surge of population growth; this disturbance, used as a 'force function' in the differential equation governing population growth, with time, enables a prediction to be made concerning future world population, probably more accurate than simple linear prediction! Whatever the accuracy of this particular calculation, its importance would seem to lie in its deliberate introduction of a cause of non-stationariness into the calculation. But we should be wary of drawing analogies between human population problems and those of say, insects or microbes.

Perhaps a more subtle obstacle lies in the fact that many social systems of interest do not involve populations astronomically large in number. These numbers may lie in that difficult region—somewhere between the vast aggregates with which statistical mechanics is concerned, and the few which might be dealt with adequately by causal analysis. Another advantage possessed by the physicist is his freedom to experiment; he may control temperatures, pressures and other macroscopic properties. But the social scientist cannot so readily disturb his population, though he can wait for wars, floods, slumps, strikes and other calamities to do it for him. We can observe their statistical results and learn from these.

One most successful application of the methods of statistical mechanics to a social phenomenon has appeared within recent years as the 'Statistical Theory of Communication'.[1] Strictly, this work has evolved from the needs of telecommunication engineers, to deal with measurement of the information capacity of their telephones, telegraphs, etc. The field of application of this theory has been rigidly defined, and extrapolation of the methods into broader fields of 'human communication' is fraught with pitfalls.[2] It has with some success been related to one social phenomenon—structural linguistics, yet even there it sits rather awkwardly,[3] at present.

This mathematical theory has excited widespread interest among many people, in fields outside telecommunication engineering. It is seen by many as providing a possible firm mathematical basis upon which to place studies of man's various communicative activities—so urgent is the need for exactness in linguistic, psychological and other social fields of 'communication' study. Perhaps therefore a word upon the mathematical measure of information capacity would not be out of place here.

The Statistical Theory of Communication of Information

Imagine, as the 'observed phenomenon' in Figure 1, a source of information transmitting signs to a receiver. Figure 3 illustrates this. Then how is the information, borne by these signs, to be measured? Signs can convey information only to a receiver who is in doubt; and doubt is always doubt about alternatives—we doubt 'whether A, B . . . or N', or we doubt 'if something is or is not', etc. Now in this phenomenon, the only doubts concerned are doubts about what signs are to be transmitted—what signs will be selected

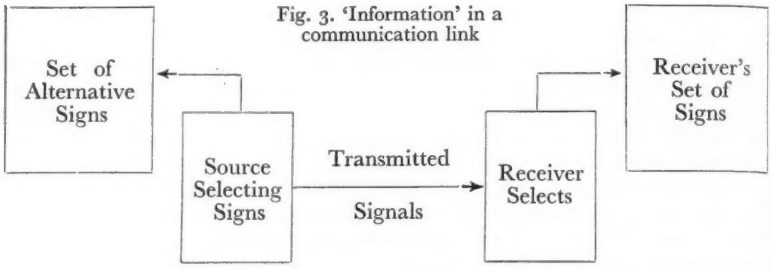
[1] C. Shannon and W. Weaver. *The Mathematical Theory of Communication.* University of Illinois Press, Urbana, U.S.A., 1949.

[2] *Communication Theory; Proceedings of a Symposium,* London, 1952. Edited by Willis Jackson. Butterworths Scientific Press, London, 1953.

[3] For 'popular' introduction, see C. Cherry, 'Communication of Information—an Historical Review', *American Scientist 1952,* vol. 40, no. 4; G. Miller, *Language & Communication,* McGraw Hill, New York, 1951.

by the transmitter from the alternatives. These alternatives form a set or 'alphabet', assumed to be possessed by both transmitter and receiver. If N is the number of alternative signs in the set, then the information content of any selected sign is defined as log N. (Successive sign selections then add to the information content.)

Fig. 3. 'Information' in a communication link



But this is not the whole story. Signs which are extremely frequent do not clear up much doubt—only the rare ones do that. It is the unexpected which provides information. Then log N is used only in the case of equi-probable signs; if the various alternative signs in the set have probabilities P_1, p_2 . . . p_i . . . p_N then the *average* rate of information H of the source is defined as the expected value of log p_i, that is $H = -\Sigma p_i \log p_i$ binary digits per sign. Note that this is an average rate. The unit here is a binary digit, which is a choice between one of two alternatives $\left(\text{each of probability } p = \frac{1}{2}\right)$, the most elementary logical decision.

The probabilities here are objective; probabilities of signs, which we may imagine assessed by the external observer (Fig. 1) from the irrelative frequency of occurrence. Such relative frequencies can be estimated if the transmitter is statistically stationary; it may therefore be seen why such a measure of information rate cannot readily be applied to many situations of specific interest in social communication. We could not easily attach probabilities to the words of a single speaker, in conversation (unless he spoke for an extremely long time, upon the same topic !). The measure is more relevant to statistical sources—for example, probabilities of printed letters or words in newspapers, or books, rather than to specific individuals.[1] There exists an enormous collection of statistical data of such sources, upon which sociological studies have been based.[2]

The formula given above is interesting. It ressembles the formula, in statistical mechanics, corresponding to the entropy of a gas. There is indeed a considerable relationship between this treatment of a communication source and the mathematics of thermodynamical processes; but the two are not simply to be equated. A thermodynamic process is stochastic, and entropy measures the expected log-probability of the alternative states, of say, a gas; a communication source also has different states, and its successive transmissions from a stochastic process. We cannot discuss this interesting development of

[1] C. E. Shannon. 'Prediction and Entropy of Printed English', *Bell. Syst. Tech. Jour.*, XXX, 1951, p. 50-64.
G. K. Zipf. *Human Behaviour and the Principle of Least Effort.* Addison Wesley Press, Cambridge, U.S.A., 1949.

Boltzmann's theory in this brief article, but leave the reader with a warning; statistical communication theory[1] has no concern with the 'meaning', nor with 'value' or 'truth' of messages—it is confined purely to signs themselves.

THE PRINCIPLE OF FEEDBACK: 'CYBERNETICS'

When we are faced with some complicated organizational task, it is a natural human habit to doodle on paper—to draw networks in the form of little balloons (representing, say, people, events, things . . . nodes) joined by lines (rules, or relationship). A great deal of thinking is given expression in this way, or its equivalent. We meet such diagrams under various names, such as sociograms, flow-charts, family trees, topological graphs, electric circuits, block-schematics, etc. They are used in various disciplines; in administration, history, economics, mathematics, engineering . . ., the list is endless (Fig. 4).

Such diagrams represent patterns of relationships, with which different systems are described. They may not represent all the relationships (which may be unlimited in number) but only those selected by the observer as seeming to him, significant. There are two types; determinate and probabilistic (stochastic). For instance, in mechanics and classical physics, the various relationships may be regarded as determinate—cause and effect—but in social studies the relationships may be probabilistic. With the latter, we are faced with such vast assemblies of individuals that causal description becomes impossible; all that may be done is to choose certain attributes, certain quantities or functions, as averages and deal with the relationships between them. Being statistical, such description cannot be exact and determinate, but must contain implicitly random disturbances; the relationships will possess certain 'spreads'.

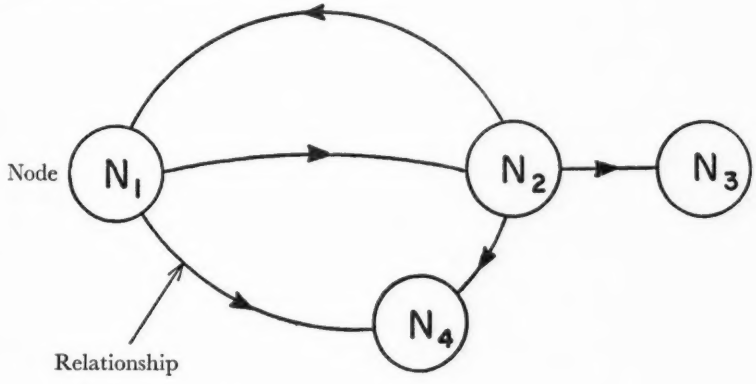


Fig. 4. Pattern of relationships, or network

[1] The expression 'information theory' is sometimes used; but in the writer's opinion this is to be deplored, since information theory originally applied to certain aspects of the methodology of physical experimentation rather than to the communication process *per se*.

This network concept is used, as already observed, in many fields of sociology and the relevant mathematics of networks (combinatorial topology) is receiving increased attention in economics,[1] 'operational research,'[2] and even in psychology.[3] In the physical sciences, topology of networks has received a remarkably extensive application among electrical engineers in the study of electric circuits; originally their networks represented determinate relationships (simple differential equations) between certain electrical elements, but more recently attention has been given to the effects of random disturbances among the electric currents which flow in the networks. The telecommunication engineer is specially concerned with such disturbances, which he refers to generally as noise. These disturbances may be specified only statistically, so that the behaviour of his electrical networks cannot be described by the engineer in terms of simple differential equations—but here the statistical Theory of Communication comes to his rescue.[4]

Amongst the many suggested applications of the mathematical methods of the electrical engineer to social studies, one may be mentioned here. Tustin has proposed applying the extensive experience of electric network analysis to aspects of economics.[5] Economics, he points out, is concerned with complex systems of dependence, with relationships between such quantities as prices, incomes, rates of investment, etc.—representable by networks. The relationships here are certainly specifiable only statistically; individuals will depart from the mean, giving 'spread' or probability of error to the assumed average relationships.

The whole possibility of developing such analogy with real practical effect would seem to rest upon the wisdom and far-sightedness of the economist, in his selection of the particular attributes, the quantities of importance, of the system described and, probably more difficult, in determining the mathematical relationships between these quantities. Such relationships will most certainly be non-linear, and complex networks of interrelationships may lead to insoluble sets of equations. But two modes of assistance arise, both of which may soon alter the whole approach to the study of social systems. Firstly the increasing development and accessibility of high-speed digital computing machines and, secondly, the building of physical analogues.

Concerning the latter, the most relevant analogues are those electro-mechanical machines called Servos, which are a particular class of network employing the principle of feedback. This principle is well-known to the general reader in such forms as the thermostat, the speed-regulator, the automatic pump and a thousand other devices. All these simple machines are control systems—for controlling temperatures, speeds, rates of flow, etc. For illustration, Figure 5 illustrates the network representing the thermostat principle. Here we have a power source which, through a switch or controlling device supplies a heater (e.g., the electric supply mains feeding an electric fire). The temperature of the heated air is measured by a thermometer and automatically compared with a setting for some desired temperature. The

[1] A. Tustin. 'Economic Regulation through Control System Engineering', *Impact of Science on Society*. Unesco, vol. IV, no. 2, summer 1953.
A. Bavelas. 'A Mathematical Model for Group Structures', *Applied Anthropology*. Summer 1948; L. S. Christie, R. D. Luce and J. Macy. *Communication and Learning in Task-Oriented Groups*. M.I.T. Report no. 231 (R.L.E.). Cambridge, U.S.A., 1952.
[3] K. Lewin. *Principles of Topological Psychology*. McGraw Hill, 1936.
[4] Shannon & Weaver, ibid.
[5] Tustin, ibid.

difference between the actual and the desired temperature is limited to some maximum threshold value. When this is exceeded, a signal is fed back to the switch controlling the power source.

This is a childishly simple example. Today the mathematics of such feedback systems has been developed to most elaborate extents; it is possible now, in principle, to analyse or to predict the behaviour of such systems of any complexity.

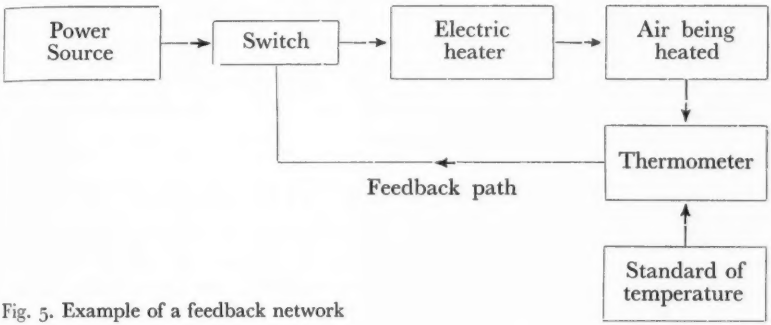


Fig. 5. Example of a feedback network

We may therefore today be in the position which Herbert Spencer coveted, but could not achieve with his vague descriptive analogies between social structures and organisms (see section 'Mathematical models of society'). All that we wish to emphasize to sociologists, who may be sceptical of the methods of engineers, is that we are not comparing things here—not comparing social systems with machines *per se*—but comparing function; we are suggesting that the mathematical methods of describing the operations of this class of machine (determinate or statistical) may be worthy of the attention of sociologists seeking to describe the patterns of society; the ebb and flow, action and reaction, the sources and types of social instability—the whole dynamics.

It has long been appreciated that the principle of feedback appears in diverse forms in Nature and in man-made machines. Not only in many fields of social studies, in learning, in economics, perhaps in crowd behaviour, but to a remarkable extent feedback is employed in the animal body for the purpose of controlling many actions. Thus there are feedback neural 'circuits' in the body which control blood-temperature, pulse-rate, posture stability, chemical balances of all kinds, and a hundred others. To this whole field, Norbert Wiener[1] has applied the name cybernetics (a name first used by André Ampère,[2] to mean 'the science of government').

All such feedback systems are control systems. We may regard them all (social, animal or machine) as goal-seeking. The thermostat 'seeks' a prescribed temperature; the human body 'seeks' certain necessary levels of electrical, mechanical or chemical balance, for its preservation; society seeks a multitude of goals. All such goal-seeking activity can proceed in a stable or unstable manner; at the social level, this procedure may perhaps be observed—but at the machine level, this observation has been backed up by elaborate theory,

[1] N. Wiener. *Cybernetics*. Wiley & Son, New York, 1948.
[2] André Ampère. *Essai sur la philosophie des sciences*. Paris, 1834.

and the precise life-histories of feedback actions may be analysed in detail; behaviour may be predicted and, what is more, may be controlled. Whatever the future may see, with regard to the application of mathematical methods to social studies, it seems safe to predict that these methods will not be so very different from that of statistical mechanics, and cybernetics.[1] However, the building of such mathematical models is one thing—but first must be selected the relevant attributes of the social system, and these must be specified, together with the quantitative relationships between them. That is, we need not only a mathematical apparatus, but a proper, and fruitful way of applying it. And this requires the wisdom and experience of the social scientist.

THE RELEVANCE OF MATHEMATICS TO CONTROLLED EXPERIMENTATION IN SOCIOLOGY

LEON FESTINGER

In recent years there has been, at least in the United States, a growing enthusiasm for the possible uses of mathematics in sociology and in social psychology. 'Possible uses of mathematics' does not mean here the use of mathematics in statistics or in measurement and scale construction. What is referred to is rather the hope of being able to state empirically relevant hypotheses about social behaviour in mathematical terms and to make derivations from this theory by means of rigorous mathematical manipulations. There are a number of such efforts underway which we will later describe. At present, however, the use of mathematics in the above sense is more a hope and faith than a reality. It is consequently appropriate for us first to discuss what is hoped for from such use of mathematics and why, if it becomes a reality, it will be extremely relevant to controlled experimentation.

Mathematics is, essentially, a set of techniques for deductive reasoning, and such techniques for deductive reasoning can be extremely valuable. When a theory becomes so complex that one cannot easily see all its implications, mathematics, if applicable, could enable the rigorous derivation of deductions and implications, some of which might only have been guessed at and others of which might mot even have been foreseen. Sometimes, of course, 'so complex' is a low degree of complexity indeed.

One might then ask why mathematics, representing, as it does, a powerful aid to theoretical reasoning, is not used all the time. The difficulty lies in the fact that one must know exactly and specifically what one is talking about and what one is saying before it can be stated in terms amenable to mathematical techniques. In other words, before mathematics can be used as an aid

[1] E. C. Cherry. 'Cybernetics', *Nature*, 1953. Report of Papers by Cherry, Hick and Mackay, as read at British Association meeting in Liverpool, 1953.

to theoretical thinking, the theory in question must be very specific and unambiguous. This advanced state of affairs, unfortunately, hardly exists in the fields of sociology and social psychology, and this is why the application of mathematics remains a hope rather than a reality. In fact, to convince oneself that most theoretical statements are vague and ambiguous one need only attempt to state a sociological theory in mathematical terms.

When an interrelated set of hypotheses are stated in specific and unambiguous terms, precise data are usually required to test the implications. Because controlled experimentation frequently yields information of a more precise and unequivocal nature than do other types of studies, the application of mathematics has special importance for such studies. Mathematics may help to formulate a theory to explain the results of an experiment or it may suggest controlled experiments to test some mathematically stated hypotheses. We will give a number of examples of ongoing uses of mathematics in such contexts to illustrate how it is used and what its current value seems to be.

Interest in the use of mathematics in sociology was greatly increased with the publication of the *Theory of Games and Economic Behavior* by von Neumann and Morgenstern.[1] Let us examine the impact which this mathematical theory of games has had on controlled experimentation. The theory of games is a mathematical system which enables one to deduce how one party in a certain restricted kind of competitive situation should act so as to produce optimal results for himself. (A great oversimplification, but that is all that is possible in a brief statement.) The theory of games leads to definitive mathematical solutions when the following conditions are met: each possible action of each competitor, and the payoff to each competitor of each combination of actions, are known to all in advance; when the number of competitors being considered is two, or one considers one of them against all the others; and when the situation is such that the gains and losses of the competitors always total to zero or some constant amount. Needless to say, this set of restrictions, when adhered to precisely, makes the theory of games quite inapplicable to sociological problems. Furthermore, the theory of games is not a theory of how people behave but is rather a theory of what, according to certain definitions, would be optimal strategy in such competition.

Peculiarly enough, however, despite these limitations, the theory of games has begun to have a very interesting impact on controlled experimentation. It has, for example, enabled Dr. Morton Deutsch[2] to devise an experimental situation in which he can, with a high degree of control, study tendencies toward competitive and co-operative behaviour. The experimental situation is one suggested by the theory of games and is precisely one of those situations which cannot adequately be handled mathematically. It is a situation where the total of the winnings and losses of the two competitors or players do *not* add up to a constant amount. Under these circumstances one can devise a situation where, if they engage in what superficially looks like optimal strategy to each, both of them lose heavily. They can both gain only if they behave as though the other person is friendly and co-operative. The theory of games has thus enabled the development of a technique for controlled experiments on competition versus mutual trust.

---

[1] J. von Neumann and O. Morgenstern. *The Theory of Games and Economic Behavior*, Princeton University Press, Princeton, 1947.

[2] Work now in progress at the Human Relations Research Center, New York University.

Another example of the impact of the theory of games on controlled experimentation is an experiment done by Hoffman, Festinger and Lawrence.[1] Curiously enough, again a part of the theory of games which is rather inept mathematically has made impact, specifically, a part which deals with three-person games and which attempts to analyse, mathematically, the formation of coalitions. The impact on controlled experimentation again took the form of suggesting an experimental situation which could be used effectively in studying how certain factors affect competitive tendencies and how they affect coalition formation among any two of the three persons in the situation.

It is perhaps no accident that the theory of games has had this kind of impact. After all, it is not a sociological or psychological theory and can hardly be expected to deal adequately with sociological or social psychological phenomena. It does, however, enable one to construct situations where, from an understanding of the mathematics of 'optimum action', one can better compare the effects of different sociological and psychological variables.

Another instance of mathematical work which has had an impact on controlled experimentation is the development of mathematics for dealing with 'group structure'. The sociological problem which has been formulated in this connexion is, in its essence, a simple one although the mathematical problems involved become very complex. Considering that in any collection of persons there are different degrees and kinds of relationships among the persons, one may set out to systematize and to develop a mathematics for dealing with this variety of relations. The simplest case which can be specified is one where certain connexions or relationships among persons either do or do not exist. For example, for any pair of persons one might specify whether or not they communicate with one another or whether or not they work together. The variety of configurations and networks which can exist in a group in even this simple instance is bewildering. A mathematical system which would enable one to solve problems concerning such configurations and networks would be of obvious value. The major mathematical area which is relevant to solving these problems is what is known as the 'theory of graphs', mainly developed by König,[2] but as yet of limited usefulness. Harary and Norman[3] have worked out possible uses of the mathematical theory of graphs in social psychology.

Once more its major application has been in suggesting techniques of controlled experimentation which have been useful. Bavelas[4] and Leavitt[5] and others have done a number of experiments where the connexion or lack of connexion among individuals in a group is specified in terms of the possibility or lack of possibility of their communicating to one another. Experimentally this can be done with relative ease. These experiments have mainly concerned themselves with the effect of different 'patterns of connexions' among the members of a group on (a) the effectiveness with which the group can solve problems; (b) the morale and satisfaction of members of the group; and (c) the emergence of leadership in the group. The actual application of mathematics

[1] P. J. Hoffman, L. Festinger and D. H. Lawrence. 'Tendencies toward Group Comparability in Competitive Bargaining.' *Human Relations*, vol. 7, 1954, p. 141-59

[2] D. König. *Theorie der Endlichen und Unendlichen Graphen.* Chelsea Publishing Company, New York, 1949.

[3] F. Harary and R. Z. Norman. *Graph Theory as a Mathematical Model in Social Science.* Institute for Social Research, Univ. of Mich. Press, Ann Arbor, Michigan.

[4] A. Bavelas. 'Communication Patterns in Task-Oriented Groups.' *J. Accoust. Soc. Am.*, 22, 1950, p. 725-30.

[5] H. J. Leavitt. 'Some Effects of Certain Communication Patterns on Group Performance.' *J. Abnorm. Psychol.*, 46, 1951 p. 38-50.

to the social psychological problems involved and to the data, however, has been minimal. Thus far, the major contribution of the mathematical formulations has been to suggest the experiments in the first place.

A different, and highly interesting, attempt at applying mathematics to social processes is presently being carried out by Hays and Bush.[1] They have concerned themselves with trying to analyse a very simple, restricted, controlled situation. The problem which they put is essentially this: Given a group of three persons who, functioning as a group, are required to solve a problem which involves learning, what minimal mathematical formulation is necessary to account for the speed of learning which the group shows? Considering only one aspect of the group interaction, namely, the extent to which the individuals in the group are affected by or influenced by the other individuals in the group concerning each decision they make, it is possible to state two extreme hypotheses which must include within them all possibilities. One extreme formulation would be that each individual acts as an individual, completely unaffected by what the others say or do. The other extreme is to imagine that the effect of the person who answers first is complete and exerts a definitive influence on the others in the group. The authors are able, mathematically, to derive the course of group performance under these two extreme hypotheses and are currently engaged in conducting experiments with three-person groups in appropriately restricted situations to test which of these, if either, comes appreciably close to describing what actually happens.

This, of course, represents an effective application of mathematics. A set of hypotheses has been stated specifically, certain derivations have been made mathematically, and experiments can be, and are being, conducted to test the derivations. Yet, I expect there are many who would wonder about the fruitfulness to sociology or social psychology of this kind of approach. It makes sense, then, for us to examine the limitations of this kind of endeavour without detracting from its present or potential value. First of all, the situations, and the set of hypotheses, with which this mathematical formulation deals are so narrow and circumscribed that its usefulness for broader theory in sociology and social psychology will be very limited. A proponent of this kind of endeavour might, however, feel that this is exactly the way to start; that once the mathematics is developed, and the hypotheses substantiated for such a narrow realm, the theory can then be broadened and extended.

A sceptic might also point out that even within the narrow realm dealt with by the mathematical formulation, it is almost certainly wrong. That is, neither of the extremes will turn out to be the actual state of affairs. A proponent might feel, however, that this way of proceding will eventually lead to the discovery of a correct formulation and then the hypotheses and the mathematical model will be altered appropriately.

Clearly, one cannot tell at this very early stage whether such an application is or is not fruitful. One can only hope that it will be fruitful.

I would like to give one last example of what is probably the most ambitious, and perhaps the most promising, of the attempts at using mathematics in sociology or social psychology. This is the work of Simon,[2] and of Simon and

[1] D. G. Hays and R. R. Bush. 'A Study of Group Action.' Laboratory of Social Relations, Harvard University. Unpublished manuscript.

[2] H. A. Simon. 'A Formal Theory of Interaction in Social Groups.' *American Sociological Review*, 17, 1952, p. 202-10.

Guetzkow.[1] These men have attempted to take existing theory in sociology or social psychology which is, to some extent at least, substantiated by empirical data, and to state such theory in mathematical terms. This has been done now in two different instances, first for a number of interrelated hypotheses stated by Homans[2] concerning determinants of friendship and group interaction, and, secondly, for a number of interrelated hypotheses stated by Festinger[3] concerning the informal processes of communication and influence in groups.

In both cases, the system of interrelated hypotheses, which were stated verbally, seemed to Professor Simon to describe what was essentially an equilibrium system, that is, one in which the interrelations among the variables was such that a change in one produced changes in others until the system reached a new point of equilibrium. He felt that such theories could be adequately handled by a system of non-linear differential equations. Translating the verbal statements of hypotheses to such equations is by no means easy. It becomes clear that the verbal statements of the hypotheses, while they may seem fairly specific, are not specific enough to allow them to be stated in terms of differential equations without a number of additional more specific assumptions. This they were able to do surprisingly well. The result is that they have produced a mathematical statement of a fairly broad theory which has accomplished several things. First, it has made clear where some of the points of vagueness and ambiguity are in the verbal statement of the theory. Second, it has shown that the deductions which were made semi-intuitively from the verbal theory can be deduced rigorously and mathematically.

This, however, is only part of what such a mathematical statement should do. The authors of the mathematical system hoped to be able to claim that:

'(a) It helps us know more precisely what mechanisms or structural relations are being postulated, sometimes calling attention to the need for further clarification of the operational meaning of definitions and statements.

'(b) It enables us to discover whether certain postulates can be derived from others, and hence can be eliminated as independent assumptions; whether additional postulates need to be added to make the system complete and the deductions rigorous; and whether there are inconsistencies among the postulates.

'(c) It assists in the discovery of inconsistencies between the empirical data and the theories used to explain them.

'(d) It lays the basis for the further elaboration of theory, and leads to deductions from the postulates that suggest further empirical studies for verification.

'(e) It aids in handling complicated, simultaneous interrelations among a relatively large number of variables, with some reduction of the obscuring circumlocutions demanded by non-mathematical language.'

And indeed, if the fourth claim had been substantiated, it would have been a clear and unequivocal contribution which could not have been achieved without the aid of mathematics. If the authors had been able to show that at some point where the verbal theory was vague or ambiguous, consequently leaving a choice of formulation, different seemingly plausible assumptions

[1] H. A. Simon and H. Guetzkow. 'Communication resulting from Pressures toward Uniformity in Groups.' Carnegie Institute of Technology. Unpublished manuscript.

[2] G. C. Homans. 'The Human Group.' New York, Harcourt Brace, 1950.

[3] L. Festinger. 'Informal Social Communication.' *Psychological Review*, 57, 1950, p. 271-82.

led to different derivations which could be tested, then the mathematical formulation would have led to growth of the theory. Another valuable contribution would have been to derive from the mathematical formulation some consequence or implication which had not been foreseen because of the complexities of the system and the inability to think it through without mathematical aids. Such a contribution would have increased the value and utility of the theory. Unfortunately, neither of these two types of contribution were forthcoming, and consequently, although the work of Simon and Guetzkow is an impressive contribution and, to date, the most promising use of mathematics in social psychology, we must still look to the future to bring its promise to fruition.

One could supply still other examples of attempts to apply mathematics to sociology and social psychology, but most of them would simply duplicate the points already made. To sum up, a few things should be said about what seem to be the major difficulties in the way of using mathematics in sociology and social psychology today.

Thus far mathematics has not proven immensely useful in social psychology. The faith that it will in the future prove useful must undoubtedly stem from the fact it has been so invaluable in other sciences, mainly in the physical ones. But even in the social sciences we can find examples, such as economic theory, where mathematical formulations have been extraordinarily helpful in systematizing theory and in allowing the derivation of new and different implications, sometimes even of a quantitative nature. Why then is there the difficulty we see in connexion with sociology and social psychology?

The opinion has been expressed that one of the difficulties lies in the fact that the mathematics which exists today has been developed largely under the spur of problems faced by the physical sciences and, consequently, may not be the mathematics needed in sociology. Thus, it might be argued that new mathematics must be developed. This may or may not turn out to be true, but it is in any event no stimulus to new mathematical developments. Before the situation is ripe for the application of mathematics, it is not possible to foresee what kind of mathematics needs to be developed to handle the problems of the new field.

This last, I think, is the crucial difficulty in applying mathematics. The theories which exist, few enough though they may be, are not specifically enough stated and the problems are not cogently enough delineated to enable us to ask sensible questions with respect to mathematics. A forced attempt to use mathematics under such circumstances easily leads to a mathematical statement which has little to do with real problems or else leads to formulations which are trivial in the sense that they perform little that could not have been performed with the verbal statement itself.

In my opinion, when we have theory which is stated with relatively few points of ambiguity and vagueness, and when this theory approaches a state of complexity which cannot be thought through unaided, then the formidable problem of finding mathematical formulations can be approached on a sensible basis with much hope for progress.

THE ROLE OF MATHEMATICS IN ECONOMIC PREDICTION AND STABILIZATION

ARNOLD TUSTIN and RICHARD C. BOOTON, Jr.

INTRODUCTION

One of the chief purposes of economics is to create an apparatus of thought by which the consequences of economic actions may be predicted. The storekeeper has to predict the effect of raising the price of his tomatoes, and the President of the United States has to predict the effect of reducing taxation. Both find their task difficult, and if they read books on economics they may well declare that economists live among abstractions too remote from the real world to be useful to them.

This has been inevitable. A long and arduous effort in abstract conceptual thinking has been necessary to fashion the tools for the job. But a new attack on the problems of the real world is gathering momentum, and major victories, if not yet fully achieved, are clearly in sight. One central and urgent problem is the elimination of business fluctuations. The causes of booms and slumps and practical means of attaining high and stable employment are questions on which intensive work is in progress. The aspects of economic study that deal with such problems, and with quantitative economics in general, are now usually distinguished as 'econometrics'. The purpose of this article is to indicate the kind of problems that arise in this field and the place of mathematical reasoning in their formulation and solution.

This new movement towards a quantitative approach to the problems of the real world is part of a phase of economic thinking that began with the work of Lord Keynes, who has written eloquently about the 20 years of mental striving that preceeded his *General Theory* of 1935. In this book, Keynes made two essential contributions that opened up a path to progress. He formulated a simple conceptual scheme or model that accounts for the main characteristics of an economy as a whole, in terms of a very few aggregate quantities or variables, such as the total of incomes and the aggregate rate of saving. He also pointed out, as an essential factor in the real situation, that the rate of real investment (i.e., the making of capital goods) does not *depend on* prior savings, but is *determined* by the expectation of profit, and he clarified ideas about the way rates of interest are determined.

THE RELATIONSHIPS BETWEEN QUANTITIES IN AN ECONOMIC SYSTEM

Many problems in econometrics, including that of prediction and eventual stabilization of the activity of an economic system as a whole, depend upon the discovery and formulation of quantitative relationships by which one quantity depends on another. The ultimate quantities in economics are the amounts of individual transactions, but insofar as common causes influence the action of many individuals, there exist corresponding relationships between the

totals or aggregates of the amounts of these transactions. For example, when the total disposable income of consumers increases, the total of goods bought increases. Whether the increase is a proportional one, or what other factors in the economic situation also systematically influence it, are examples of the kind of problems that must be solved by econometrics before the dynamics of this system can be put on a quantitative basis. In any case, no such relationship can be exact. One might postulate that an extra income Y might create proportionally extra buying kY and might seek to discover the best-fit constant of proportionality k. But the reasons why a particular Mr. X is going to buy a television set tomorrow are not raised. One invokes the 'law of large numbers' and expects that the actions of Mr. X and Mr. Z more or less average out except insofar as they are due to *common* factors in the economic situation. There must always be some variation of any aggregate that remains unaccounted for by the systematic relationships that can usefully be formulated. The only kind of economic 'laws' that one may use for practical deduction are approximate relationships. One may write for example,

$$\text{C} = \text{rate of purchasing of consumers goods} = \text{F(Y, Z . . .)} + u,$$

stating that C depends upon, or is a function of, other aggregates such as Y, Z . . ., but it also includes an additional element u, which represents the effect of a multiplicity of other circumstances. If all the regular or consistent effects are included in F(Y, Z . . .), the remaining element u will be random or uncorrelated with any of the other independent variables. Such relationships, containing random terms, are called stochastic relationships.

An aim of econometrics is to discover what set of such economic quantities (aggregates) together with relationships of dependence of one on another, all subject to such random extra variations, will best account for the actual behaviour of an economy in a particular era. That scheme of quantities and relationships is best which leaves the smallest amount 'unaccounted for' or represented by the random additions such as u in the above equation. If such remnants are small, predictions made by such schemes will be relatively reliable.

THE MAIN STRUCTURE OF ECONOMIC RELATIONSHIPS

An account of the working of an economic system that could be adequate for prediction must be rather complicated. A number of such schemes, having various degrees of complexity, are currently under examination. In this introductory account, it is impossible to deal with the necessary elaborations and complexities, and attention will be confined to a few principal quantities and variables, and the interdependence between them, which are the common structure of all such 'models'.

There is a great advantage in representing the relationships by a diagram, and Figure 1 shows the structure of relationships generally accepted as the basic ones. It should be kept in mind that in practice this elementary scheme is elaborated by the inclusion of many more variables and additional relationships. In Figure 1, the circles indicate economic quantities, and lines with arrows are shown, from a quantity Y, for example, to another C, indicating that Y directly affects C, and the arrows may be marked with some indication of the quantitative relationship they represent. This main structure of economic

relationships has two main loops or closed sequences of cause and effect: one relating to consumption goods and one relating to capital or investment goods.

The consumption goods sequence is represented by the upper loop in Figure 1. The total of incomes Y influences the amount of consumption C and

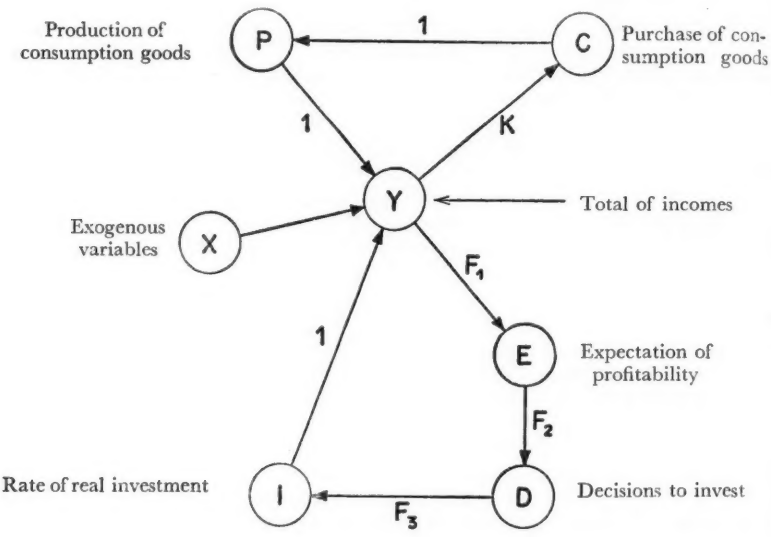


Figure 1. A simple scheme representing the principal causal relationships in an economy.

this relationship is assumed to be one of proportionality so that the consumption C equals kY. Because, on the average, as many goods must be produced as are consumed, the production of consumption goods P is assumed to be equal, at least in this simple model, to the consumption C as indicated by the 1 on the upper line of the figure. The money disbursed as wages and profits in the making of these goods adds to Y, thus closing the consumption goods loop.

Similarly, the investment relationships are represented in the lower loop, where for simplicity a simple but inadequate version is shown. Total income Y (which corresponds with aggregate production) is represented as determining the expectation of profitability E. This in turn determines the rate of decisions to invest D, which determines the actual rate of investment I (production of real capital goods). The wages and profits associated with the production of capital goods and thus with investment I contributes to the total income Y, thus closing the lower sequence.

This simple model is completed by inclusion of a separate contribution X to the total income Y. This independently determined quantity represents such variables as government buying or employing, less taxation, and any excess of exports over imports.

Such a scheme of dependence as that shown in Figure 1 corresponds with

a system of equations relating to the variables Y, C, I, etc. The behaviour of the system would be determined as a solution of this system of equations, within limitations set by the inclusion of the random or stochastic terms. Economists refer to such systems of equations as 'models'. Economic theory and detailed studies of particular aspects of economic behaviour suggest a model of the kind indicated by Figure 1, but considerably more elaborate, in which perhaps twenty or more variables are thought to be necessary for adequate representation.

A PROGRAMME FOR ECONOMIC PREDICTION AND STABILIZATION

Formulation of the concepts discussed in the preceding sections might be interpreted as the first step in a comprehensive programme for quantitative economic prediction and stabilization. The tasks encountered in such a programme might be outlined as follows:

1. The systematic formulation of models representing the contemporary economy with the minimum complexity that gives adequate representation.
2. The collection and scrutiny of data on the relevant variables over a past period and their adjustment to conform with the theoretical scheme.
3. The undertaking of separate 'field studies' of such decisive factors as consumption habits (family budget studies) and of the factors influencing decisions to invest.
4. Selection of the appropriate mathematical relations describing the relations between quantities within the model and estimation of numerical values of the parameters in these equations.
5. The assessment of the statistical significance of the parameters of the model in order to assess the probable error resulting from use of the model for prediction or other purposes.
6. Prediction of future values of the significant economic quantities by use of the model as adjusted to fit the recent past. Independently determined quantities, such as government spending, should be estimated.
7. The design of stabilizing or regulative operations by which a more desirable future course of economic development may be ensured, in particular the design of a stabilizing routine to ensure a constant high level of employment.
8. The periodic revision of the model incorporating both experience and up-to-date statistics, and the progressive improvement of forecasting and regulation.

OPERATIONAL RELATIONS BETWEEN VARIABLES

Discussion of the manner in which the quantitative relations between economic variables are estimated should be preceded by a description of the forms such relations can take. The behaviour of complicated systems is relatively easy to analyse if all the relationships involved are linear, that is, if 'effects' are directly proportional to 'causes'. In such systems, the principle of superposition applies. The 'effects' of any independent variable or of any part of its variation may be calculated separately and added to the effects of other

'inputs'. Non-linear systems present more difficulty and few general methods of analysis are available. The behaviour of linear systems, however, is a good starting point. Often, non-linear systems can be approximated for particular purposes by properly chosen linear systems.

If some variable θ_0 is caused by another variable θ_a, and the causal relationship has the property of linearity, then the value of θ_0 at any time t can be represented by a weighted summation of past values of θ_a. Because in general all past values of θ_a contribute to θ_0, the appropriate form for this 'sum' is an integral. If the relationship between θ_a and θ_0 is time-invariant, this 'superposition integral' can be written as

$$\theta_0 (t) = \int_0^\infty w(\tau)\ \theta_a (t - \tau)\ d\tau,$$

where $w(\tau)$ is the weighting function that defines the relation between θ_a and θ_0.

The function $w(\tau)$ and the corresponding integral are not the only way the relation between θ_0 and θ_a can be characterized. If the function θ_a can be represented by the superposition of sinusoidal functions, that is, by a Fourier series, then attention is focused on the result of the operation when θ_a is replaced by a sinusoid. If the value of θ_a corresponding to each sinusoidal component of θ_a can be calculated, then the value of θ_0 resulting from the total function θ_a is computed by summing the components of θ_0. This procedure makes use of the assumed linear nature of the relationship.

If the component of θ_a is $\sin \omega t$, then after a transient period, the corresponding component of θ_0 has the form $A\ (\omega)\ [\sin \omega t + \varnothing(\omega)]$, where both the amplitude A and the phase $\varnothing$ depend upon ω. The operator is described by the 'transfer function' $F(i\omega)$, defined as

$$F\ (i\omega) = A\ (\omega)\ e^{i\varnothing}\ (\omega).$$

Useful results follow from extending the definition of this function so that the argument $i\omega$ can be replaced by any complex number $s = \alpha + i\omega$. The transfer function $F(s)$ is related to the weighting function $w(\tau)$ by the equation

$$F\ (s) = \int_0^\infty w(\tau)\ e^{-s\tau}\ d\tau.$$

Such a relationship is known as a Laplace transformation.

The conditions required for a linear system to be stable, that is, to be incapable of self-sustaining growth or oscillation have been fully investigated in connexion with systems met in engineering. Techniques based on the Laplace transformation and the response of the system to sinusoidal inputs are very suitable for discussion of stability. They lead to the well known 'Nyquist criterion' of stability, accounts of which are given in many books on control-system theory. These methods also make it easy to design additional dependences so as to make any given system stable. The 'explanation' of booms and slumps and the formulation of a regime of economic action to 'nip them in the bud' will follow once an adequate and sufficiently accurate representation of the interactions between economic quantities has been obtained.

The dynamic behaviour of linear systems with feedback, however complicated in structure, has a certain simplicity. The possibilities of oscillatory self-exciting behaviour are limited to oscillations that either die away or

increase indefinitely. The boundary case of a just-self-sustaining oscillation is a theoretical possibility. Exponential growth or decay is also possible.

Economic systems, however, contain several nonlinearities, the most important being the check on increase of employment as full employment is reached and the sharp drop in the rate of investment when the expectation of profit falls. Nonlinearities of this kind do not greatly alter the behaviour of the system for small perturbations, but they do set limits to the range of oscillatory self-oscillation and they modify its form. Such limited, nonsinusoidal, oscillations are referred to as limit cycles.

The fact that economic data usually are known only at a finite number of instants of time has led econometricians to the use of relations in which the present value of one variable depends upon the present value and a finite number of past values of another variable, the equations having the form

$$\theta_0(t) = \sum_{n=0}^{N} w_n \theta_a (t - n\delta).$$

Although such equations are introduced in econometrics without question as to their meaning, a closer examination into this procedure is instructive.

The use of discrete operators in econometrics can be viewed in two different ways. A discrete operator can be interpreted as a special case of the continuous operator in which certain instants of time are infinitely more important than others. Mathematically, the weighting function $w(\tau)$ can be treated as a limiting case, approaching infinity at certain points and zero at all others, in such a manner that the superposition integral becomes equal to a weighted sum of values of θ_a. Situations in which the discrete operator is a proper description may occur in economics, for example, when business decisions depend upon data released periodically by government agencies.

Usually, however, one would expect the true situation to be more closely described by a continuous operator, with the functions θ_a and θ_0 continuous functions of time. The question naturally arises as to the correspondence between the discrete operator and the continuous operator. The discrete operator can be interpreted as an approximation to the true operator, with one being forced to some such approximation by the nature of the available economic data. Comparison of the weighted sum with the superposition integral reveals that if the interval δ is small, the two expressions are approximately equal if $w_n = w(n\delta)\delta$. If δ is not sufficiently small, there may be an appreciable error in this approximate correspondence, and more sophisticated techniques indicate a more accurate, but slightly more complex, relation between the weighting coefficients w_n and the weighting function $w(\tau)$. In any case, one should not slip into the error of assuming that the operator actually has the discrete form, simply because the available data are discrete.

THE STATISTICAL ESTIMATION PROBLEM

Items *d* and *e* in the programme discussed above involve estimation of parameters in the economic model on the basis of numerical records that describe the recent behaviour of the system. From a mathematical point of view, this estimation is the most difficult part of the programme, and this short paper can only indicate the nature of the problem and the kind of

mathematical analysis to which it leads. Several recent books[1] give good introductory accounts of the present state of this aspect of econometrics.

The problem is essentially a statistical one, and advanced statistical methods are being applied to it. The statistical techniques that have been utilized range from simple minimization of mean-square error to more elaborate maximum-likelihood procedures. The more correct methods lead to very complicated computational procedures, but the extent to which this complication is justified is not yet certain. Because precise statistical procedures for the treatment of non-linear systems are not well developed, much effort has been devoted to the estimation of linear models. A realistic economic model, however, certainly must contain important nonlinear relationships. Recognition of these nonlinearities probably would be more effective even though it results in some compromise in the use of cruder statistical methods. The purpose of the analysis is a description of a real economy. For this same reason, proper weight should be given to information obtained from field studies and economic theory. Anything known about the economy should be used, even if these data are difficult to fit into a formal statistical procedure.

Statistical records exist of some, perhaps most, of the variables over some past period. No useful purpose is served by going very far back into the past. No one supposes that effective economic relationships, such as the manner and extent by which spending is influenced by incomes remains invariable over decades during which such changes as social security measures have developed. The best one can expect is that the relationships sought are stable over a period of a decade or more. Some studies that have been made have considered periods of 20 years. Ideally, one would like to give greater weight to the more recent past, and progressively less to the remoter past. Appropriate weight must also be given to prior probabilities such as those derived from independent 'field investigations'. Subject to these considerations, such values must be given to all numerical coefficients in the set of equations as will 'account for' the recent past behaviour.

The simplest way to view the problem, omitting some circumstances that are relevant but not of first importance, is to regard it as one of multivariate curve fitting. This is what has commonly been done. Figure 2 is intended merely to illustrate the principle involved, and refers to a part of a scheme of dependence such as is shown in the left side of the figure where a variable θ_0 depends directly on only two other variables θ_a and θ_b. The curves θ_a, θ_b, θ_0 are drawn through the recorded past values of the corresponding economic variables. The portion of the output quantity θ_0 caused by θ_a is indicated symbolically by $F_1\theta_a$ where F_1 is an 'operator', and similarly for the component $F_2\theta_b$ which is caused by θ_b. Other influences, which may be unknown, cause contributions represented by u_0. The dotted lines with arrows going back from θ_0 to θ_a and θ_b result from the fact that, in general, such variables are included in sequences that are closed. These lines represent the repercussions or θ_0 on θ_a and θ_b through feedback paths which may be complicated and may involve many other variables.

The equation for θ_0 is

$$\theta_0 = F_1\theta_a + F_2\theta_b + u_0$$

and it is necessary to discover the set of parameters for the operators F_1 and F_2.

[1] Gerhard Tintner. *Econometrics.* John Wiley and Sons, Inc., N.Y., Chapman and Hall, Ltd., London (1952), and Lawrence R. Klein. *A Textbook on Econometrics,* Row, Peterson and Co. (1953).

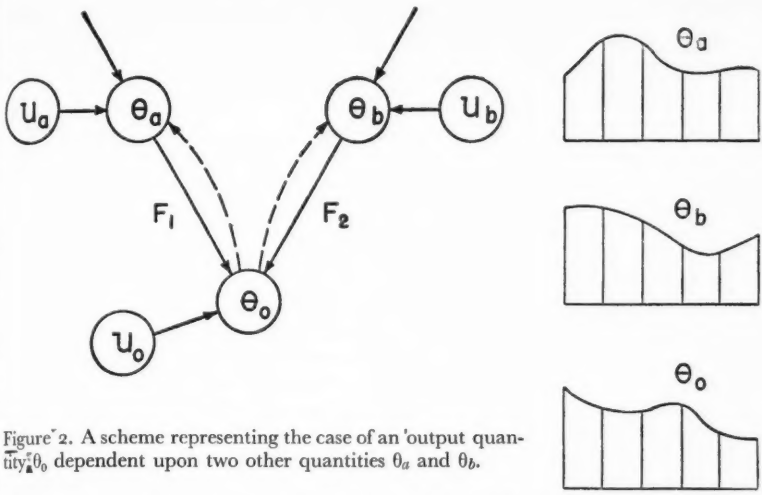


Figure 2. A scheme representing the case of an output quantity θ_0 dependent upon two other quantities θ_a and θ_b.

The usual procedure is to assume that F_1 and F_2 are linear operators, and these are adjusted until $F_1\theta_a + F_2\theta_b$ accounts for as much as possible of θ_0, in the sense that the mean square value of the portion of θ_0 that must be accounted for by the addition of u_0 is minimized. A simple argument to justify this procedure is that, if some further part of this remnant still remained and was in regular linear correspondence with θ_a or θ_b, it would be owing more likely to a wrong choice of the F_1 or F_2 than to random causes, and it would be proper to adjust F_1 or F_2 to remove this part of the remnant.

This argument may appear at first sight to be fallacious, because θ_a and θ_b are probably correlated with θ_0 and so with u_0, owing to the unknown feedback represented by the dotted lines. This might result in a part of θ_0 being attributed to the effects of θ_a and θ_b which was in fact due to u_0. This objection is a proper one and can be refuted only by attention being given to the fact that causes always precede effects.

To illustrate the procedure, the elementary case of dependence on a single

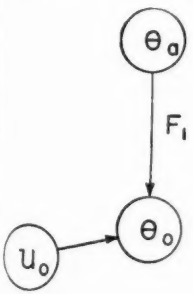


Figure 3. The simplest case, in which a variable θ_0 depends upon only one other variable θ_a.

variable, as shown in Figure 3, will be considered. The variable θ_0 can be expressed as

$$\theta_0 = F_1\theta_a + u_0$$

In order to make quantitative estimation of the operator F_1, one usually specifies a definite form for the relation between θ_a and θ_0. An especially simple form would be

$$\theta_0 (t) = w_0 \theta_a (t) + w_1 (t - \delta) + u_0$$

where θ_0 is assumed to depend on the present value of θ_a and one earlier value of θ_a. There is one such equation for each ordinate of θ_0 over the period analysed, provided there are sufficient ordinates of the input recorded. The set of simultaneous algebraic equations so obtained must now be solved for the required weighting coefficients w_0 and w_1. These equations are not exact owing to the presence of u_0, and if the period is long enough to make the calculation meaningful, there are more equations than unknowns. The solution sought is one that gives the ordinates θ_0 with the minimum square error. The familiar solution in terms of sums of cross products of ordinates is well known. If enough ordinates are involved, these sums of cross products approximate to auto-correlation and cross-correlation coefficients.

In the more complicated situation described by Figure 2, the variable θ_0 is caused by two variables θ_a and θ_b. If one attempts to generalize the methods used in the single-variable case, no difficulty is encountered so long as θ_a and θ_b are uncorrelated. If, however, as is usually the case in economics, portions of θ_a and θ_b are caused by common variables that occur elsewhere in the model, correlation exists between θ_a and θ_b. The difficulty then encountered in separation of the component of θ_0 contributed by θ_a and the component contributed by θ_b, leads to the problem known in statistics as 'identification'. This is not a technical problem peculiar to one branch of statistics, but may be encountered whenever causal relations between more than two variables are studied.

Since variables such as θ_a, θ_b, and θ_0 usually are connected by causal relations to other variables in the economic model, the use of information regarding these other variables would be expected to be of help in estimation of the relations between θ_a, θ_b, and θ_0. The most direct way of using this information is to consider simultaneously all the equations connecting all the variables. If many variables are involved, as is the case in a realistic economic model, the resulting calculations may be prohibitively complicated. Therefore, so-called 'limited-information' methods have been developed to use some, but not all, of the available information regarding the other variables, in an estimation of the relations existing in a portion of the model such as that illustrated by Figure 2.

This brief description can do little more than hint at the statistical methods that have been and are being developed for the estimation of quantitative relations between economic variables. The mathematical reader is referred to the publications of such groups as the Cowles Commission for Research in Economics[1] for detailed mathematical discussions. Enough has been said, however, to indicate that, in spite of the theoretical complexity of the statistical estimation problem, usable quantitative results regarding relations between economic variables can be obtained.

[1] 'Statistical Inference in Dynamic Economic Models.' *Cowles Commission Monograph* no. 10, edited by Tjalling C. Koopmans, John Wiley and Sons, Inc., N.Y., and Chapman and Hall, Ltd., London, 1950.

THE USE OF ANALOGUES AND OTHER MECHANICAL AIDS IN ECONOMETRIC INVESTIGATIONS

Perhaps enough has been said about the difficulties of such analysis, even on the misleading assumption of linearity, to show the desirability of finding alternative and more effective approaches than numerical analysis. It is of course possible to bring the modern high speed digital computer to bear on such calculations, but the proper basis for calculation in the case of hypothetically non-linear systems has not yet been adequately formulated, and it would present a particularly awkward and onerous problem in programming on such machines.

An alternative that is being investigated is the possible use of physical analogues. It is possible to construct physical systems of electrical or sometimes of mechanical elements, that simulate a desired set of variables and of interdependences between them. The way in which such a physical model might be used to solve the problem of matching the past behaviour of a real system would be one of adjustment by systematic trial until a 'best-fit' was obtained. Automatic recording of mean-square differences would be a desirable feature.

The straightforward type of analogue in which thermionic tubes and electric circuit elements are arranged to simulate required differential equations is very familiar. Here, attention will be called only to a somewhat different type, that might be used in a manner closely analogous to the basic type of econometric calculation which has just been described.[1]

The device which invites such use is the 'delay line synthesizer', by which any required linear dependence between a varying input quantity and an output quantity may be established. This may be used to synthesize a 'weighting function', and to adjust the weighting function to obtain the desired 'best-fit'. The delay line is a concatenation of network elements such that when any varying voltage is applied at the input, the voltages at the successive tapping points 0, 1, 2, 3 . . . n, are identical voltage variations, but delayed in time by 0, δt, $2\delta t$, $2\delta t$, . . ., $n\delta t$. For example, if a step of voltage of unit value is applied at time $t = 0$, the voltage that appears at the successive tappings is a similar step at 0, δt, $2\delta t$, . . . $n\delta t$. These voltages are amplified, and proportions of them, a_0, a_1, a_2, . . . a_n, according to the settings of a set of knobs operating potentiometers, are fed to an adder. The output of the adder is a voltage having values a_0, $a_0 + a_1$, $a_0 + a_1 + a_2$ . . . at the successive times.

Thus, by setting the knobs a voltage may be generated at the output that is the response to a unit step input, and that has any prescribed sequence of ordinates. The system is a linear system, and the complete arrangement thus provides a means of creating at will a linear system having any desired 'weighting function' within the limits of the apparatus. The weighting function, i.e., the response to a unit pulse, is defined by the set of ordinates corresponding with the knob-settings a_0, a_1, a_2, . . . a_n.

Such a device, fed by a long-period rectangular voltage wave, may be used as a function generator. Successful use has recently been made of delay line synthesisers (in a neuro-physiological problem, very analogous to the econometric problem) for finding best-fit equations, the principle being shown in Figure 4. The problem was to find the best-fit linear functions that would

[1] The authors are indebted to Professor J. Reswick of MIT for the proposal of this method.

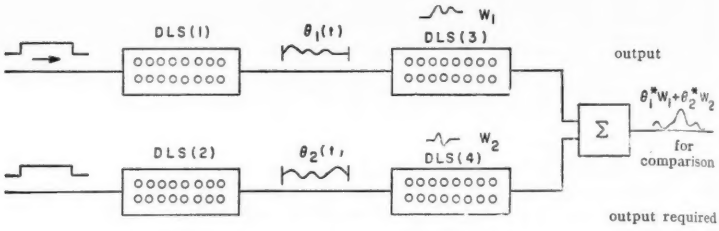


Figure 4. Arrangement of four delay line synthesizers for experimental discovery of a probable weighting function.

make the output $\theta_0(t)$ correspond with the record of the output of the actual system when the inputs $\theta_1^{(t)}$ and $\theta_2^{(t)}$ were those of the actual system.

Here D.L.S. (1) and D.L.S. (2) are delay line synthesisers, set to produce periodically repeated versions of $\theta_1^{(t)}$ and $\theta_2^{(t)}$ as their outputs. Two further delay line synthesisers D.L.S. (3) and (4) are fed by these voltages, and the output summed. The summed output reproduced as a trace on a cathode ray oscilloscope was compared, using an optical device, with the experimental output record. The procedure was to systematically vary the settings of the knobs on D.L.S. (3) and D.L.S. (4) until the closest possible fit of θ_0 to the experimental curve was obtained. The potentiometer settings on D.L.S. (3) and D.L.S. (4) then give the sets of ordinates of the weighting functions (or time functions of response to a unit pulse), corresponding with the best-fit relationships. The weighting functions having been obtained it is possible to discover the equation constants.

This 'experimental' procedure is completely in correspondence with the arithmetical process of calculating the ordinates of the best-fit linear weighting functions by the simplest procedure using the 'minimum square error' criterion.

PREDICTION IN ECONOMICS, AND THE DEVISING OF A STABILIZING ROUTINE

It is evident that the possibility of economic prediction, so far as this possibility exists, is realized as a natural corollary to the creation of an adequate model, the adjustment of its parameters to fit the recent past, and the estimation of probable 'disturbances' or inputs for the immediate future. The assumption may be made that the regularities of relationships of the recent past will hold for some further period, and the extrapolation of the calculation into the future constitutes the prediction. The further into the future the extrapolation is carried the less reliable become the predictions. This is because the model is neither complete nor exact, the regularities in the relationships will not be completely invariant, and unpredicted causes of variation not represented in the model will occur. It is only required however that the margin of probable error should be small for predictions of a year or two ahead.

The requirement that the economy should work at a high and stable level of employment requires regulatory action by a stabilizing authority. Given an adequate model it is possible to design such regulating action by exactly the same processes as an engineer would use to ensure stable operation of a physical control system, by the design and application of a supplementary feedback.

In the economic scheme 'supplementary feedback' means that some combination of operations, of the nature of variation in total spending, is made by the stabilizing authority in regular dependence on the values of a suitable index number, which may be a combination of quantities.

The index number is the 'source of feedback'. The varying 'expenditure' made as a result of the variations of the index number is the application of the feedback. The formula or rule by which the variation of expenditure is made to depend on the index number and its recent past is the equation or characteristic of the feedback. If a suitable index is selected (this should include several items that give an early indication of tendencies to cumulative or depressive change), and if, similarly, a suitable combination of regulatory actions is selected, then the manner in which the latter should depend on the former for effectively stabilizing the whole system may be calculated exactly as engineers calculate the required weighting function for a stabilizing feedback in a physical system. The barrier to the institution of such a stabilizing routine is at present the absence of an adequate and proven model, and not the lack of analytical tools for determining what is required when the model is given. Some sensitive indicators of incipient variation are for example, consumer goods inventories, mail order sales, and variations in the rate of authorized capital outlay. Possible corrective action may be a suitable combination of variations of taxation, government spending, purchase and sale of stocks of commodities, purchase and sale of bonds, capital works, and other items including measures to which response is slower.

OTHER FIELDS OF APPLICATION IN ECONOMICS OF THE SAME KINDS OF MATHEMATICAL ANALYSIS

While the understanding and eventual control of general economic fluctuations is undoubtedly the most important prospective application of analysis of the type described, analogous methods are finding important applications in other fields.

One such field is the study of the working of economic systems considered as systems of intertrading firms or groups of firms, or more generally, of 'transactors'. The basic postulate is that, corresponding with a firm's physical output, i.e. what it sells, are relatively fixed proportions of purchases from other firms. A scheme of such intertransactor relationships enables, for example, the ultimate repercussions of a given additional order to be traced throughout the economy. Studies of this kind have particularly been made by W. W. Leontief.

Another field for quantitative economic studies that involve somewhat similar mathematical techniques is the investigation of optimum rules or formulae for certain operations within individual firms or organizations. A representative problem of this class is that of maintaining working stocks or inventories at a sufficient but most economical level. As such problems are usually treated by the assumption of linearity, they are often referred to as a class by the term 'linear programming'.

CONCLUSION

This paper must not give the impression that the problems of economic stabilization are on the point of solution. The analytical techniques necessary are rapidly becoming clear, but their successful application depends upon extensive and time-consuming work in the collection and sifting of statistical data. A satisfactory solution may require extension and improvement of basic statistical services. Detailed observation and research on actual economic behaviour is also required on a considerable scale. Nevertheless, there are good grounds for hope that within the next decade or so, given increasing and adequate support, this new phase of the development of economics will have made a profound and favourable impact on the world's future.

SUGGESTIONS FOR FURTHER READING

In addition to the references given by footnotes, the following is a very brief selection from the extensive literature on this subject.

CHARNES, A., COOPER, W. W. and HENDERSON, A. *An introduction to linear programming*. New York, J. Wiley and Sons, London, Chapman and Hall, 1953.

HICKS, S. R. *A contribution to the theory of the trade cycle*. Clarendon Press, 1950.

KEYNES, S. M. *The general theory of employment, interest and money*. MacMillian, 1936.

KLEIN, L. R. *Economic fluctuations in the United States 1921-41. Cowles Commission Monograph*, no. 11, Chapman and Hall, 1950.

LEONTIEF, W. W. *The structure of American economy*. New York, Oxford University Press, 1953.

TUSTIN, A. *The mechanism of economic systems*. Heinemann, Harvard Press, 1953.

THE USE OF MATHEMATICAL METHODS IN ECONOMETRICS AND ECONOMIC STATISTICS

G. TINTNER

ECONOMETRICS

Economics has been defined as the science which studies human behaviour as a relationship between ends and scarce means which have alternative uses.[1] Another definition says: Economics is the science of administration of scarce resources in human society.[2]

Econometrics and economic statistics are special methods used in this field. The economic statistician collects and organizes economic data. Econome-

[1] L. Robbins. *An Essay on the Nature and Significance of Economic Science*. p. 16.
[2] O. Lange. 'The Scope and Method of Economics', *Review of Economic Studies*. Vol. 13, 1945, p. 19.

trics[1] may be defined as an endeavour to use the methods of mathematical economic theory and of modern mathematical statistics in order to accomplish two goals: to find numerical values for the postulated economic relationships and to verify economic laws and regularities.

MATHEMATICAL MODELS IN ECONOMICS

Mathematical techniques are useful in the construction of the theoretical models, which form the basis of econometrics. We can classify economic models in two ways: according to their scope and according to their relationship to time.

Partial equilibrium models deal only with a part of the total economic system, e.g. with one single market. General equilibrium models are more ambitious and try to explain the functioning of the whole economic system.

Static models take no account of changes in the economic system and of anticipations and expectations. Dynamic models take these factors into account. We will try to give examples for these various models and also to indicate the mathematical techniques useful in their construction. At the same time we propose to discuss some of the simpler applications of the results to economic policy.

Static Partial Equilibrium Models

We consider a single market and take not into account the changing nature of economic relationships. Let us for instance analyze a single commodity market and the demand for this commodity. The quantity demanded will depend on the following variables: price of this commodity, income, prices of related commodities, etc.

As an example we consider the demand for butter in Sweden 1925-37.[2] The demand for butter depends on the price of butter, the price of margarine and income. The relationships are assumed to be linear in the logarithms of the variables, which permits the immediate estimation of price and income elasticities.

The elasticity of the demand for butter with respect to the price of butter tells us by what percentage the demand for butter will decrease, if the price of butter increases by 1 per cent. All other factors (price of margarine, income) are assumed to be constant. This is the condition of *ceteris paribus*. This elasticity is estimated as -0.9. Hence, if *ceteris paribus* the price of butter increases by 1 per cent, the demand for butter will decrease by 0.9 per cent, on the average.

The elasticity of the demand for butter with respect to the price of margarine is similarly defined: if *ceteris paribus* (income and price of butter constant) the price of margarine increases by 1 per cent, the demand for butter will increase by about 0.35 per cent.

Finally we have the income elasticity of the demand for butter: If *ceteris paribus* (prices of butter and margarine constant) income increases by 1 per cent, we may expect that the demand for butter will increase by 0.55 per cent.

The knowledge of these elasticities may be important for private entre-

[1] G. Tintner. 'The Definition of Econometrics', *Econometrica*. Vol. 21, 1953, p. 31-40.
[2] H. Wold. *Demand Analysis*, p. 231ff.

preneurs, e.g. managers of a dairy co-operative, people working in the oleomargarine industry, etc. The importance of these results for economic policy is also apparent. Suppose for instance that the government fixes the price of butter or margarine. Then it has to take into account the elasticity of the demand for butter with respect to the price which has been fixed by government action. Suppose on the other hand that the government subsidizes consumption (increases income). Then it has to take into account the income elasticity of the demand for butter, etc.

Other static partial equilibrium models which have been developed in mathematical economics include the following: supply functions, relationships between the quantity supplied on a single market and the price of the commodity in question. Cost functions are relationships between the total cost and the quantity of the commodity produced. Production functions describe the relationship between the quantity of the commodity produced and various factors of production used (land, different types of labour and capital). Utility functions try to describe the way in which a given group of individuals chooses between different goods and services available, etc.

The mathematical techniques useful in the construction of static equilibrium models are essentially the simple concepts of algebra, supplemented by the principles of differential calculus. In utility and production theory we meet problems of maxima and minima, which necessitate the application of somewhat advanced methods of the differential calculus. Modern formulations of the theory of choice use also methods of mathematical logic.

All these models and methods go back to the classical work of the great mathematical economists, especially Cournot, Walras, Pareto, Irving Fisher and Marshall. But some new ideas have been introduced into mathematical economic theory in recent years. These are the methods of game theory: economic phenomena are considered as games of strategy, e.g. chess. These models seem to be especially appropriate in fields like bilateral monopoly (one seller faces one buyer), oligopoly (a few sellers face many buyers), oligopsony (a few buyers face many sellers), etc.

Related to the ideas of games of strategy are methods of linear programming. They belong essentially to production theory, but may also be useful in other fields. A number of possible production processes are defined in a simple way. Linear programming tells us which particular combination of available processes will be used, given certain criteria (e.g. maximum net profits).

The mathematical methods used in linear programming are the theory of systems of linear equations in many unknowns. Related theorems belonging to matrix calculus are also used. Game theory proper utilizes rather advanced methods of set theory, topology and group theory. The theory of convex sets is also used in these fields.

Static General Equilibrium Models

Static general equilibrium models go back to the work of the great mathematical economists, especially Walras. On the basis of their work many modern models have been constructed, especially by the followers of Lord Keynes.

Such a simple model[1] has been given by Haavelmo. It consists of two

[1] T. Haavelmo. 'Methods for Measuring the Marginal Propensity to Consume', *Journal of the American Statistical Association*. Vol. 42, 1947, p. 105-20.

equations and one identity. He used data from the United States, 1930-41. The first equation is the consumption function. Here consumption is expressed as depending on income. The marginal propensity to consume is the average fraction of one dollar's income which is being consumed, rather than being invested. It is estimated as 0.712. From this figure we can compute the so-called multiplier. This is the total income resulting from the additional investment of one dollar, assuming that the same fraction is invested and re-invested again and again. This multiplier is estimated as 3.47. The knowledge of the marginal propensity to consume and of the multiplier are evidently very important for purposes of economic policy. They may for instance be used to estimate the additional government investment necessary in order to make up for lack of private investment.

The second equation in the system relates gross business savings to the sum of consumption and gross investment, i.e. gross capital formation plus government net deficit. The identity says, that income is by definition consumption plus gross investment minus gross business savings. Assuming conditions to be similar to the ones prevailing during the period of investigation we can express consumption, disposable income and gross business savings as functions of gross investment, i.e. gross capital formation plus government net dificit. These relationships should also be useful in government planning.

The mathematical methods useful in the study of static general equilibrium models of this type are algebra and differential calculus.

A more elaborate static model of general equilibrium is the input-output analysis of Leontief. The total economy is partitioned into a number of compartments: agriculture, various industries, government, households. A table shows the net output of all the compartments and also the flow from each compartment to all the others. From this information it is possible to compute coefficients of production, which are assumed to be constant. The coefficient of production shows the amount of input of a given kind (e.g. labour, a specific type of capital) which is necessary to produce a unit of output in the given compartment. This type of information is potentially very useful in economic policy. It can be utilized, for instance, to investigate the overall effect of a given wage policy.

The mathematical methods used in input-output analysis are the solutions of systems of linear equations in many unknowns. Matrix computations are also useful with these models.

Dynamic Models of Partial Equilibrium

Static models take time not into consideration. In dynamic models we deal with anticipations and expectations: It is not the current profit which influences the actions of the entrepreneur, but the expected or anticipated profit. It is not the current price alone which influences supply, but also the anticipated or expected price, etc. Expectations and anticipations are based upon past experience.

A theoretical study of dynamic economic phenomena requires the study of (subjective) probability distributions of profits, prices, technological conditions, etc. The investigation of the laws of probability requires some knowledge of set theory and measure theory, and the use of the integral calculus.

If we study the derivation of anticipations or expectations from past

experience, we have to use rather advanced methods of the calculus. This problem may involve differential equations, difference equations, integral equations and mixed types. The calculus of variations may also be useful in this connexion.

As an example, consider the study of the dynamic demand function for steel by Whitman.[1] He used data from 1902-30 in the United States and tried to verify the following models: (a) demand for steel depends upon the present price of steel and also involves a time trend; (b) the demand for steel depends upon the present price of steel and the time derivative of the price of steel; (c) the demand for steel depends upon the present price of steel and upon a weighted average of past steel prices; (d) the demand for steel depends upon the present price of steel, the time derivative of the price and a weighted average of past steel prices.

Empirical results in this field may be useful to private industry, e.g. the producers of steel. They are also important for economic policy, e.g. in connexion with anti-trust measures.

Dynamic Models of General Equilibrium

If we construct dynamic models of the total economy we have to use dynamic relations like those described in the previous section. This leads to the application of rather advanced mathematical methods. We have to deal with systems of differential equations, integral equations, difference equations and possibly also with mixed forms. If the equations are not linear the use of topological methods becomes necessary.

As an example we mention the extensive study by Tinbergen of the American business cycle, 1919-32.[2] This is a very elaborate system consisting of no less than 70 variables, many of which enter with time-lags. Non-linear relationships are made linear by approximations. Apart from definitional relations (identities), demand, supply and price equations for goods and services and for money and capital are constructed.

ECONOMIC STATISTICS

The economic statistician is concerned with the collection and presentation of economic data. The econometrician, on the other hand, analyses these data in order to get numerical estimates and to test economic laws and hypotheses.

It is unfortunate that much of our fundamental data in many countries is still derived as by-products of administrative processes. Personal income distributions, for instance, are derived from income tax statistics, etc. It would be very desirable if more econometricians could interest themselves in the tasks of collecting and presenting economic data. It would be even better if the professional economic statisticians could familiarize themselves with economic theory and econometrics.

The person concerned with the collection and presentation of economic data should be familiar with the modern theory of statistics. This involves a

[1] R. H. Whitman. 'The Statistical Law of Demand for a Producer's Good as illustrated by the Demand for Steel', *Econometrica*. Vol. 4, 1936, p. 138-52.

[2] J. Tinbergen. *Statistical Testing of Business Cycle Theories*. Vol. 2. *Business Cycles in the United States of America, 1919 1932.*

knowledge of the fundamentals of probability theory, which requires a knowledge of set theory and perhaps measure theory. The methods of mathematical statistics use algebra and calculus, especially integral calculus.

The collection of economic data is very expensive. This is the reason why complete censuses are taken so infrequently. But much economic information is required yearly, or even monthly. In order to obtain the desired information at the lowest possible cost the methods of sampling and sample surveys are applied. These are very important recent techniques with which the economic statistician should be familiar.

We obtain a random sample under the following circumstances. Each unit has the same chance to be chosen from the total population. This may be accomplished by drawing lots or by using a table of random numbers. Sometimes it is better to stratify the population according to some principle and take stratified samples; within each stratum the units are selected at random. Other methods are double sampling, systematic sampling, etc. What particular method of sampling is the best depends upon the use which is to be made of the data. Hence it is necessary for the economic statistician to be informed about the ultimate use of the data by the econometrician.

SPECIFIC ECONOMETRIC QUESTIONS

There are a number of techniques which are common to econometrics and other applications of statistics. But there are also some problems which arise solely in econometrics and should be studied by econometricians and economic statisticians. They are mostly problems which are neither purely statistical nor purely economic, but properly econometric.

Aggregation Problem

The classical models of general equilibrium of Walras and Pareto provide much theoretical information for the economist. But if the econometrician wants to deal with such models empirically, he has to take into account the great complexity of these magnificent theoretical structures. Strictly speaking, there ought to be millions and millions of equations. It would be a hopeless task to try to verify all these models.

For this reason we have to aggregate the quantities in these models in order to achieve a sensible small model, which can be verified empirically. The problem of aggregation is essentially nothing else but the old general index number problem. How should we aggregate the thousands of prices into one price index? How should we aggregate the many quantities produced into one index of production, etc.? The degree of aggregation depends of course on the model which is to be constructed. Partial equilibrium models have a lower degree of aggregation than general equilibrium models. Among general equilibrium models the Keynesian models seem to have a higher degree of aggregation than the input-output analysis model, etc.

There is not as yet much agreement about the criteria of a good general index number. Some criteria[1] have been proposed which take into account the fact that the macromodels (constructed with the aggregated quantities)

[1] K. May. 'The Aggregation Problem for a One Industry Model', *Econometrica*. Vol. 14, 1946, p. 285.

should have properties similar to the micromodels which refer to the quantities to be aggregated.

An important special problem in the field of index number or aggregation theory is the cost of living index number. In this field a great deal of progress has been made through the development of the modern theory of choice (utility theory). It is possible to compute limits for the 'true' cost of living index of a group of people and also to find suitable approximations.

The mathematical techniques used in the field of aggregation theory include differential calculus and the theory of differential equations. Matrix methods are also being used.

Identification

The problem of identification is the following. Given a certain economic model, is it possible to derive from a set of data the structural relations of the model and to estimate the structural coefficients which we desire to know? Structural relations are for instance: demand functions, supply functions, production functions, cost functions, etc. Structural coefficients are: the price elasticity of demand, i.e. the percentage change in the quantity demanded, if *ceteris paribus* the price increases by 1 per cent; marginal cost, i.e the increase in total cost if the quantity produced is increased by one small unit, etc.

These structural relationships and structural parameters are important from the point of view of economic policy:[1] if for instance the government fixes a price, one would like to know what the demand of the commodity at the fixed price will be. This involves a structural relationship, the demand function (relationship between quantity demanded and price) and a structural parameter, the price elasticity of demand (percentage decrease in the quantity demanded if the price increases by 1 per cent).

The problem of identification requires a classification of our variables. The endogenous variables are the truly economic variables and their number should be equal to the number of equations in the model. The endogenous variables are jointly determined by the equations.

Secondly we have the exogenous variables. These are variables which influence the model studied but are not influenced by it. Truly exogenous variables are rather rare. An example would be weather conditions. But some endogenous variables can also sometimes be considered as exogenous in certain models of partial equilibrium. For instance, if we are studying a single market, we may consider income as an exogenous variable for this purpose. In a short run model of production fixed capital may be considered exogenous, etc.

In the same category as exogenous variables fall also predetermined variables. These are lagged values of the endogenous variables. In dynamic models we may for instance assume that the supply of a commodity with a fixed period of production depends not on the contemporary price but upon the price of this commodity with a lag equal to the period of production. This lagged price is a predetermined variable.

Take as an example the market for one single commodity. Our model consists of two equations: The demand function is a relationship between the quantity

[1] J. Marschak. 'Economic Measurement for Policy and Prediction' in W. C. Hood and T. C. Koopmans, ed. *Studies in Econometric Methods*, p. 1-26.

and the price; the supply function also is a relationship between quantity and price. Evidently these two equations are not identified.

But let us enlarge our model by two exogenous variables. Now the demand function is a relationship between quantity, price and income, the last an exogenous variable. The supply function is a relationship between quantity, price and cost, the last being an exogenous variable. Both structural equations are identified and structural parameters, e.g. elasticities, may be estimated.

The method of estimation depends upon the probability assumptions introduced into the model. We may for instance assume errors in the equations (resulting from omitted variables), errors in the variables (similar to errors of observations), normality of the distributions, etc.

The study of the identification problem in linear models requires the knowledge of the mathematical theory of determinants and their ranks. If a deeper study is desired, we have to take into account the problems of causal relationships and their meaning and interpretation in economics.

It is the problem of identification which reveals the intimate connexion between the economic model (derived with the help of mathematical economic theory) and the statistical analysis of the data. If the equation is not identified, then no statistical analysis of the data can reveal the desired structural relationships or give us estimates of the structural parameters, which we desire to know.

Time Series Analysis

Modern statistics, substantially the creation of the genius of Sir Ronald Fisher, have made tremendous progress in biological and industrial applications—where experiments can be arranged in such a fashion that the outcome has random character and is subject to the laws which govern the probability of independent random events.

No such experimentation is possible in the social sciences, certainly not in economics. Most of our data come in the form of time series, i.e. they are ordered in time. We may for instance have yearly production data, monthly price series, weekly series of sales of department stores, etc. This difficulty can be avoided if we have data from survey samples, but this is rarely the case.

It is the time series character of much of our data which makes the statistical analysis of economic observations difficult. It is not possible to utilize without change the statistical methods which have had great success in other fields. Their applicability is due to the random character of the original data. But we cannot postulate, for instance, that this month's wheat price is independent of last month's price. If this was the case, we would be living in a kind of random economy and the planning of economic action would be more uncertain than it is, at least in the short run.

Whereas we cannot use directly most of the techniques developed by modern statistics, we shall of course have to apply the general principles of modern statistical inference. But their application is a great deal more difficult in econometrics than it is in many other fields of applications.

Various methods have been proposed to deal with this problem. The difficulty is that, in the short run, various different models seem to fit the data equally well. We rarely have series which are long enough to enable us to choose between models.

One simple way of dealing with this problem is the transformation of

observations. We transform our raw data in such a way that the transformed data will fulfil approximately the postulate of randomness. This may be done by computing secular trends, by taking finite differences (Variate Difference Method), by making auto-regressive transformations, etc. But we do not really know the character of the process as it presumably exists in the unknown population and hence the nature of our transformations must be determined from the data which form only a small sample drawn from the population.

Another method is the analysis of our data from the point of view of stochastic processes. Here great progress has been made, but again we have to determine the nature of the particular process from the data themselves. And with the short series at our disposal there are great difficulties in distinguishing between various possible processes which appear equally plausible. The small sample theory is still in a very rudimentary state in this field.

The mathematical techniques used in time series analysis include set theory, measure theory, the theory of functions of real and of complex variables. Some advanced methods like differential, difference and integral equations may also be useful.

STATISTICAL PROBLEMS

The methods of modern statistics are of supreme importance for econometrics and economic statistics. Even apart from the specific econometric difficulties mentioned above there are a great many open questions in statistical analysis. The econometrician should follow the rapid development of modern statistical inference and analysis and try to utilize the specific methods which are most appropriate for his own purposes. In a subject matter with so many conflicting ideas the best attitude is perhaps an eclectic one.

Probability

There is not much agreement about the fundamental concept of probability, on which all statistics are based. There are essentially two schools of thought: one holds that probability is connected with relative frequency, the second that it refers to the degree of conformation of propositions.

Among the first school which relates probability to relative frequency there are again a number of different interpretations. Richard von Mises and Reichenbach hold that we have to define probability as the limit of the relative frequency as the sample becomes infinite. Most statisticians follow the Russian mathematician Kolmogoroff and define probability as the quantity which fulfils some basic axioms. Sir Ronald Fisher defines probability as the relative frequency in a hypothetical infinite population.

The second school of probability theorists is sometimes called the subjective school. Lord Keynes and Sir Harold Jeffreys hold that probability statements pertain to propositions. They express the degree of confidence we should rationally hold for a given statement in face of the empirical evidence.

Rudolf Carnap thinks that both concepts of probability are useful. The first concept of probability relates to relative frequency or the limit of relative frequencies. In economic work, we may for instance think of the probability of a business failure as the limit of the relative frequency of failing businesses

among all enterprises, as the sample of businesses becomes larger and larger. Alternatively we may think of the probability of business failures as the relative frequency of failing businesses in the hypothetical infinite population of all business enterprises.

On the other hand the second concept of probability is useful if we consider for instance the following question: certain phenomena can be explained in terms of the 'classical' approach to economics or alternatively in terms of the Keynesian system. To what extent do our empirical data confirm each one of these theories and how should we rationally choose between them? It should be mentioned that Carnap's concept of the second kind of probability (degree of confirmation) is not yet far enough developed to deal with most of the problems which arise in econometrics.

Estimation

In econometrics we try to derive numerical results from our data by the methods of mathematical statistics. The particular relationships which we want to obtain depend of course on our model. They are structural relationships. They represent technological relations in the production of commodities and behaviour equations which show the attitude of certain groups of people.

For instance, the marginal productivity of labour in the United States has been estimated from data covering the period 1921-41.[1] The estimate was $2,280 per worker. This technological relation may be interpreted in this way: assume that conditions are on the whole similar to the ones prevailing in the United States during the period analyzed, and that *ceteris paribus* (especially the amount of capital remaining constant) one additional worker is employed. The increase in the working force will increase the value of the total product of the American economy by $2,280. The importance of the estimate for economic policy is apparent. It could be taken into account in questions relating to labour policy, immigration policy, etc.

As an example for behavioural equations we quote the following. From data in the United States during the period 1919-41 the price elasticity of the demand for meat[2] is estimated as —0.471. The income elasticity is estimated as 0.406. These results should be interpreted in the following way. Suppose that conditions are on the whole similar to the conditions prevailing during the period analyzed in the United States. Assume further that the price of meat increases by 1 per cent, *ceteris paribus* (especially income remaining constant). Then we may expect the demand for meat to decrease by not quite one-half of 1 per cent. Under similar conditions, assume now that *ceteris paribus* (price of meat being constant) the income increases by 1 per cent. Then we may expect the quantity of meat demanded to increase by about two-fifths of 1 per cent. These results have an obvious interest for entrepreneuers like meat packers and economists concerned with the agricultural policy of the United States.

Modern statistical inference provides us with the methods by which these estimates and similar estimates can be computed. The two most important ones are the method of maximum likelihood and the method of least squares. They lead often, but not always, to the same results.

If we use the method of maximum likelihood we obtain our estimates

[1] G. Tintner. *Econometrics*, p. 134-43.
[2] G. Tintner. ibid, p. 327-9.

according to the principle of maximizing the probability. We assume the general form of the distribution and then obtain our estimates in such a fashion, that they give the greatest possible probability to the sample, i.e. to our actual observations. Maximum likelihood estimates have a number of desirable properties. We mention only one of these: if we compute maximum likelihood estimates from larger and larger samples, then under given conditions it is almost certain that the deviation between our estimates and the parameter estimated will become as small as we like.

The marginal productivity of labour, for instance, has been computed by the method of maximum likelihood. It is a consistent estimate of the parameter in the population, i.e. the 'true' marginal productivity of labour is the (unknown) population. If we make estimates using the method of maximum likelihood we are almost certain that the difference between our estimates and the parameters estimated will be as small as we like, if only the sample becomes very large.

The method of least squares leads to estimates by making the sum of squares the deviations of the observations from the estimate of minimum. It is applicable under somewhat less stringent conditions than the method of maximum likelihood. The method of least squares has again certain desirable properties: least squares estimates are unbiased. If we make a great many estimates, and compute the arithmetic mean of our estimates, then it is almost certain that the mean will be equal to the parameter estimated.

The price and income elasticities of the demand for meat have been computed by the method of least squares. They are unbiased estimates of the population parameters, i.e. the 'true' price and income elasticities of the demand for meat in the (unknown) population. If we compute a great many estimates by the method of least squares and take their arithmetic mean, it is very likely that this average will differ little from the value of the population parameter.

Fiducial or Confidence Limits

The mathematical economist can only give us (sometimes) an idea about the sign of certain structural constants. For instance, the price elasticity of demand will be negative, if the commodity is not an inferior good (i.e. a good of which less is bought if income increases with constant prices). But the econometrician can actually present numerical estimates for these parameters.

If we have estimates we would like to judge their validity in some way. For this purpose we compute fiducial or confidence limits. Fiducial and confidence limits gave different interpretations and do not always coincide. These difficulties arise not, however, in the simple cases with which we deal here. We interpret confidence limits in the sense of J. Neyman.

These limits are computed in such a fashion that they will enclose the (unknown) true parameter in the hypothetical infinite population in a certain fraction of all cases (confidence coefficient). This will be true in the long run, on the average.

Suppose we compute the confidence limits for the price elasticity of the demand for meat indicated above. Out estimate of this elasticity was —0.471. The confidence limits, computed with a confidence coefficient of 0.95 are —0.707 and —0.235. We may make the following statement: if conditions are similar to the situation prevailing during the period analyzed, if further

ceteris paribus (especially income remaining constant) the price of meat increases by 1 per cent, then the demand for meat will decrease by not less than about one-fourth of 1 per cent and by not more than about seven-tenths of 1 per cent. This statement and similar statements made with a confidence coefficient of 0.95 will be true in 95 per cent of the cases, in the long run, on the average. In about 5 per cent of the cases they will be false, i.e. the (unknown) true elasticity of demand in the hypothetical infinite population will fall outside the limits computed.

Tests of Hypotheses

The verification of economic laws is one of the most important purposes of econometrics. Statistically this problem becomes the testing of hypotheses.

We follow here essentially the Neyman-Pearson theory of testing hypotheses. In testing a hypothesis we commit two types of errors: we may reject a true hypothesis (error of the first kind) or we may not reject a false hypothesis (error of the second kind). Tests of hypotheses should be constructed in the following way: for a given level of significance (probability of the error of the first kind) we try to minimize, if possible, the probability of an error of the second kind.

It is asserted in the Keynesian theory that the supply of labour depends upon money wages rather than upon real wages (i.e. the ratio of money wages to the cost of living). We have tested this proposition with the help of data from the United Kingdom for the period 1920-38.[1] We test the hypothesis that the supply function depends upon real wages, i.e. the ratio of money wages and the cost of living index. A test of this hypothesis indicates that, within a margin of 5 per cent, it is not refuted by our data.

This result is to be interpreted as following: if we test many hypotheses using always the 5 per cent level of significance, we will not reject a true hypothesis in 95 per cent of the cases and reject it in 5 per cent of all cases, in the long run, on the average. The test is also constructed in such a way that it minimizes the probability of not rejecting a false hypothesis.

The methods of statistical estimation, computing of confidence limits and testing of hypotheses involve rather advanced mathematics. Differential and integral calculus is needed as well as some knowledge of set theory.

A very comprehensive theory of statistical inference has been developed by A. Wald. This is the method of decision functions, which includes as special cases estimation, testing of hypotheses as well as many other statistical problems. One such problem is multiple choice, which is of great importance in econometrics. We have to choose frequently between a number of hypotheses.

The theory of decision functions is also closely connected with the theory of games and with economic action under conditions of risk and uncertainty. It is, however, doubtful if this method is applicable in econometrics. In order to be able to apply it we must have an idea of the loss function, which gives us numerical values for all possible losses connected with wrong decisions. It is very unlikely that this should be possible with economic problems. The particular principle of minimizing the maximum risk (negative expected gain) used by Wald implies a very conservative policy. For these reasons it seems doubtful if this method is really applicable in the social sciences.

[1] G. Tintner. *Econometrics*, p. 143-53.

MATHEMATICAL METHODS IN PUBLIC OPINION POLLS

P. THIONET

Up till now, mathematics have played only a relatively modest part in the social sciences. The latter, the youngest of the sciences, are still very far from achieving results which (as in the physical, or even the biological science)[1] can be reduced to equations. Nevertheless, intelligent—but inadequately informed—people would probably tend to think that, if a mathematician concerned himself with sample surveys, it would be in order to study the results and attempt to identify their inner significance. But the amount of analytical work which can be done on data in the choice of which the investigator has had no say is really very limited; and, for the presentation of the results, only elementary types of statistical method are involved, in which mathematics have little place. On this side, therefore, the mathematician's part will end with the giving of a certain amount of advice on when it will be best to use a 'broken line', a bar digram, or, let us say, a logarithmic scale.

However, one really essential consideration still remains. In the social sciences, the whole of a population or even of a social group cannot be covered by observation; this must necessarily be confined to a limited number of elements—in other words, to a sample. Here, since there are mathematical theories on sampling and of reasoning on samples, the mathematician has something to say; he will have his own ideas on how to select the samples and on how to set about evaluating the results secured. So far, admittedly, the theories on deduction from samples and their 'tests' do not appear to have exercised any marked influence on investigation by sampling. Yet, inasmuch as observation in the social sciences (more particularly in public opinion research) cannot cover the whole of the group under investigation and must accordingly be restricted to a sample, caution is advisable before generalizing from or 'extrapolating' the data secured; and the theories in question are accordingly of interest. It would, nevertheless, be an error to assume that they are applicable to every form of partial investigation. They are only valid when certain assumptions as to sampling (i.e. the method followed to select the sample) and as to structure (of the whole under study) are fulfilled.

The required sampling assumptions are, in general, extremely restrictive; the majority of tests of significance still relate only to extremely simple Bernoullian samples, and the sampling procedures now in general use ('cluster' sampling, two-stage sampling, etc.) remain, in the present state of theory, outside the scope of these tests. This is all the more so in the case of samples arrived at without recourses to the methods of random selection.

As regards the assumption on structure, these mostly come down to assuming that the distribution of individual observations in any group follows the Laplace-Gauss or 'normal' law (i.e. they can be plotted a a bell-shaped

[1] Or economics.

curve).[1] Incidentally, in the social sciences at any rate, this assumption is rarely fulfilled. The discouraging nature of all these limitations will be apparent. While tests can always be used, the conclusions drawn from them can be accepted only with such reservations that their interest is greatly reduced thereby.

We have therefore not felt necessary to expatiate on these methods at length, bound up as they are with the mathematical theory of experimentation and still difficult to put to extensive use.

In the paper that follows, Part I will deal, as non-technically as possible, with mathematical methods of sampling. In Part II, the present methods of public opinion surveying will be described, with an indication of whether they have been influenced to any marked extent by mathematical theory.

PART I

MATHEMATICAL METHODS OF SAMPLING

Before beginning to describe the methods themselves, it must be made quite clear to the reader that the results reached by these methods are not claimed to be better in every case than those secured by other procedures without a mathematical basis.

The distinctive feature of the mathematical method is the introduction of mathematical rigour, with the notions of freedom from bias and the precision of the estimate given by a particular schema or sampling design. A few simple examples will render these abstract concepts comprehensible.

SAMPLING DESIGN: BERNOULLI DRAWING

The basic procedure employed at least once in any sampling design is what is known as the Bernoulli drawing.

The principle is as follows. Each of the individuals in the population (say, a town) to be surveyed is represented by a lottery ticket; n winning tickets are then drawn by lot,[2] the holders forming a Bernoulli sample of n persons.

The drawing of the winning numbers can be carried out, either with ordinary lottery equipment, or by taking (a) the numbers corresponding to the winning numbers of the official lotteries or (b) 'random numbers' obtained by equivalent procedures specially designed for the drawing of samples for statisticians (Tippett's tables, 1926; Fisher and Yates's tables, 1938; Kendall and Smith's tables, 1939; the Burke-Houghton tables of 1949, etc.).

Random selection can be used to pick any kind of 'sampling unit'

[1] It should, however, be pointed out that the 'normal law' is central to the calculation of probabilities in the sense that, whatever variates be taken, the mean of n of them (if n is sufficiently large) will conform fairly well to the 'normal law'. It thus comes about that many theorems are only fully established for distributions conforming to the Laplace-Gauss law but remain true, as a first approximation, for distributions following laws which are very different.

[2] It should be pointed out that the same ticket may come out several times, and it will have to be decided in advance whether it can count twice or whether another ticket must then be drawn. These two sampling procedures are equally valid but quite distinct.

(individuals, households, 'blocks', communes, etc.), and more particularly for drawing 'clusters' (all the members of a household, all the pupils in a class or school, etc.). The 'cluster' may be a sequence obtained by taking every 'Kth' individual; the drawing of one of these sequences is known as systematic sampling. The Bernoulli drawing is accordingly an efficient procedure as it stands, and it will become clear later that on occasions it is advantageous to have certain individuals represented by several lottery tickets.

UNBIASED ESTIMATION (WITH A BERNOULLI DESIGN)

The object of a sample investigation is to evaluate, to estimate, certain unknown characteristics of the population: what proportion of listeners want more music in broadcasting programmes, or how many hours, on the average, an individual spends looking at television. These proportions, these averages, can be estimated from the proportions noted in the samples. A given Bernoulli design yields a particular sample, but can also yield different samples in practically unlimited numbers. Of a given characteristic x, the sample produces an estimate X; but X would differ for each of the other potential samples. The estimate X is a random number in the sense of the calculus of probabilities. All these possible values X (if they were ever calculated) would have x as their mean and would be distributed round x symetrically, the distribution being bell-shaped (or the shape of a cocked hat); in other words, $\mathrm{X}-x$ follows the 'normal' distribution law (at a first approximation at least—and if the size n of the sample is great enough). The estimate X is accordingly said to be an unbiased estimate of x; this means that x is equal to the mean value $\mathrm{E}(\mathrm{X})$ of what would be the distribution of X if an infinite number of other samples (always of size n) were drawn by the same procedure.

THE 'PRECISION' OF AN ESTIMATE

The estimate X may be very different from x; the most that can be said is that there is a strong probability that it will not diverge too widely. For every 'normal' curve, a parameter of scatter, σ, is calculated, known as its standard deviation, representing half the distance between the two points of inflexion. An essential property of the Laplace-Gauss law is that only about 5 per cent of the values of X fall outside a range equal to four units of standard deviation (two on either side of the mean value). In the present instance, the quantity σ is called the standard error of X, and σ^2 is the variance of X.

The precision of the estimate X is sometimes measured by the inverse, $\frac{1}{\sigma^2}$, of the variance. Obviously, the smaller the variance or standard error, the less the estimate X is likely to diverge from x—and accordingly the greater its precision. It is however more usual to measure the precision of an estimate in terms of $\left(100\,\frac{\sigma}{x}\right)$ per cent and to say, for instance, that the precision of a result is 3 per cent (which, in strict technical language, is no longer its 'precision' but its 'co-efficient of variation'). With a Bernoulli drawing,[1] if $p = x$

[1] This is only true for the procedure under which the same individual can be drawn several times. If this probability is excluded, σ takes another value, near enough in practice but involving the size of the population sampled.

is a proportion to be estimated, it may be of interest to know that the variance (for a sample of n individuals) is $\sigma^2 = \frac{p(1-p)}{\sigma}$.

If x however does not designate a proportion, σ^2 is expressed differently but remains inversely proportionate to the numbers in the sample.

DEVELOPMENTS FROM THE BASIC PROCEDURE

The variety of the methods which may be adopted as the basis for a 'sampling design' will be mentioned later in this paper. Nevertheless, a sampling design as such is only valid theoretically if every element in the population sampled has a specific probability of inclusion in the sample.

Thus there is no basis in mathematical theory for any sampling in which the investigator remains free to choose the quarters to be interrogated, or the organization chooses the communes to be visited according to ease of access, etc. To avoid all confusion, let us put it that the mathematician chooses his design but draws his sample.

The sampling design yields one particular sample from an infinite family, F, of possible samples. The data collected on the sample are worked upon with an estimator, a mathematical formula for arriving at an estimate of a given magnitude; the estimator is said to be unbiased if the family of possible estimates which could be reached from the family of samples is well centred on the magnitude to be calculated. The estimator is said to be precise if the scatter in the family of possible estimates is small.

The bias or systematic sampling error is the divergence between the value to be calculated x and the mean value E (X) of the estimates X; more precisely E (X) is called the mathematical expectation of X.

If the bias is nil, the estimate is sometimes described as 'absolutely correct'; it is deemed correct or 'unbiased' when the bias is much smaller than $(X-x)$. The sampling error $(X-x)$ is the sum of the systematic error (or bias) and the random error.

The variance σ^2 of the estimate X and its standard error σ can be determined as for a Bernoulli schema on the basis of the limiting law (Laplace-Gauss) applicable to X. Their mathematical expression depends on the size of the sample, the structure of the population and the sampling design adopted; it may be extremely complex. The degree of precision of X can also be given as a percentage of the standard error (or coefficient of variation).

CALCULUS OF ERRORS

On the conclusion of a sample poll, it is possible, if the design was well conceived, to evaluate the standard error of each estimate made. It is in this respect that mathematical sampling methods surpass all others: they provide information on the precision of the results. In practice, however, the calculations of errors are lengthy and imprecise, and computations have to be abbreviated and their numbers restricted.

It is likewise possible, before carrying out a poll, to evaluate the order of magnitude of the standard errors to be expected. This however is simple prognosis, often falsified in the event; for it is based on analogy with polls

already effected and on the results of pilot surveys, on a very small scale, which are assumed to be representative.

The following are certain points which it is essential to bring out clearly:

1. Recourse to the Bernoulli design presupposes the possibility of reviewing, and allotting numbers to, all the individuals—the elements—included in the purview of the investigation.
2. It is a current error, which must be corrected, to assume that two limits are determined (by the calculation of errors) between which the result sought undoubtedly lies. The limits usually adopted (two units of standard error) signify only that there are 95 chances out of 100 of finding the value sought between them. They would have to be moved farther apart to secure 98 or 99 chances out of 100, but would never lead to a '100 out of 100' certainty.
3. The efficacy of the Bernoulli design (in other words, the precision $\frac{1}{\sigma^2}$ of the estimate) is subject to two conditions: a sufficiently large sample, a sufficiently concentrated populations.[1]
4. Talking about the precision of a survey has no specific meaning. It is perfectly usual for one and the same survey to give precise results for the territory covered as a whole, and only approximate results for each of its component regions. Likewise, it is usual for one and the same 'listener preference' survey to afford very precise information on how many people like broadcast plays, and only the roughest idea of how many like symphonies.

We shall now describe the various methods whereby the Bernoulli survey can be improved.

CONTROLLED SAMPLES

When mathematical sampling methods are used, ultimately it is chance that is essentially relied upon for the provision of samples which will be 'representative' in the non-technical sense; this in fact they will be in so far as they themselves are large enough and the sector surveyed is sufficiently homogeneous. However, if acceptably precise results are to be secured, it is necessary in some sort to assist pure chance by using all the supplementary information it is possible to get on the population under study.

By 'supplementary information' is meant, for instance, prior knowledge, from government statistics of population and population movements, of the latter's age and sex structure—if, of course, the survey covers the inhabitants of an entire country.

The initial idea (in point of time) appears to have been to use this knowledge in order to secure as representative a sample as possible. The difficulty is to combine random sampling and control of the structure of the sample. In their earliest efforts—which, incidentally, were concerned with economic statistics (e.g. Jensen's surveys in Denmark in 1925)—the investigators sacrificed 'randomness' to 'balance', whereas the mathematicians—e.g. Bowley, 1926—could find no way of dispensing with the drawing. Following Gallup's lead, the public opinion surveys have committed themselves wholeheartedly to a

[1] Hence the desirability of adopting sampling units with the maximum possible mutual homogeneity and consequently the maximum possible internal heterogeneity.

procedure similar to, but distinct from, Jensen's: whereas Jensen controlled the structure of his sample with reference to a whole series of quantitative criteria by procuring the same mean values in the sample as in the population as a whole, the public opinion institutes control the structure of theirs on qualitative criteria, by procuring identical proportions in the sample as in the population.

The examples which follow will show, however, that sampling can be controlled without departing from strict mathematical rectitude.

Suppose a Bernoullian sample has been drawn of 544 women and 456 men, whereas the proportion of men in the population is 48 per cent. This sample could be rejected and another drawn (which it would be advisable to do after improving the sampling procedure so as to avoid similar fiascos). This, however, might not be convenient, and there are alternative remedies:

Example 1. 50 of the women can be eliminated from the sample by random selection, thereby restoring the correct balance between the numbers of women and men. It should here be remarked that the reduction in the numbers from 1,000 to 950 is offset by a reduction of the survey costs, so that, strictly speaking, no loss of precision is involved (provided, of course, that the elimination is effected before the start of the field work).

Example 2 (F. Yates: *Balanced Sampling*).

Suppose, now, that the n individuals in the first sample have been allotted numbers from 1 to n in the order in which they were drawn; No. 1 is replaced by another person with the number n plus 1; next, No. $(n + 2)$ is substituted for No. 2, and so on, until the stage at which the sample consisting of the individuals No. $(p + 1, p + 2 \ldots p + n)$ has reached a sex structure conforming to that of the population surveyed.

Improvement of Precision

When a correct control method is used, obviously a balanced sample will be secured, and one which is more precise than that originally drawn.

If the structure of the sample is controlled for characteristic X and if the same sample is used for the investigation of characteristic Y, mathematical theory shows us that the variance of estimates of Y from samples will be reduced by 100 ρ^2 per cent

where ρ is the coefficient of correlation between X and Y.

We know that the absolute value of ρ lies between 0 and 1. If there is a high degree of correlation between X and Y, the gain in precision will be considerable. For instance, if $\rho = 0.70$, the variance will be less by half (49 per cent, to be exact).

Control of the structure in respect of several characteristics X, X′, and X″ at once is possible but rather difficult to effect in practice. If these characteristics were uncorrelated, the percentage reduction in variance would equal $100 - 100\ (1 - \rho^2)\ \ (1 - \rho'^2)\ \ (1 - \rho''^2)$.

However, in practice it will never be so large, as X, X′, X″ are always more of less mutually correlated.[1]

[1] It should be pointed out in addition that, if X denotes age, the formula is not valid with more than two major age groups, etc.

If the degree of correlation between X and Y is no more than moderate, it is completely useless to seek to employ X to control the structure of the sample (always a laborious task). For instance, for $\rho = 0.20$, the variance would be reduced by 4 per cent only.

Balancing the structure of the sample in terms of sex, age, and profession is accordingly only indicated if the investigation covers characteristics in definite correlation with these criteria.

STRATIFICATION

While random selection goes back at the very least to Jacques Bernoulli in the eighteenth century, the stratification procedure would appear to date from Poisson in the nineteenth. Stratifying a population means dividing it up into strata (in other words, into segments) within which independent samplings, for instance by Bernoullian lot, will take place. This method is only of interest on the assumption that each stratum is a segment of the population in which homogeneity as regards the characteristics being studied is higher than in the population as a whole.

It would appear that, in its initial phase, stratification was conceived to have as its necessary sequel the drawing by lot of the same proportion of individuals from each stratum; this obviously yields a sample more representative than that which would be secured by a Bernoullian drawing from the same proportion of the total population without stratification. Such, anyhow, was the design worked out by Poisson.

In the present state of theory, the search for maximum 'representativeness' of the samples has been entirely abandoned in favour of a search for maximum precision in the estimates. It was realized that it was often advantageous to vary the sampling fractions from stratum to stratum, subject to appropriate weighting of the results secured in each. In this way the precision both of certain overall estimates and of the estimates per stratum can be much improved. In point of fact the stratum is often also a separate sector of opinion; thus interest will attach not merely to the opinion of wine growers as a whole, but also to the (widely divergent) opinions of small and large wine growers respectively. The latter being few in numbers, the fraction sampled must be considerably higher than that of the small growers, in the opinions of the two groups are to be determined and compared with adequate precision. Arriving at the answer for wine growers as a whole will thereafter amount to calculating the weighted means.

It may be pointed out, in passing, that the principle of stratification can be utilized for every type of sampling unit—for individuals, households, territorial divisions (communes in France, counties in the United States of America, etc.) or economic units (industrial or commercial undertakings, farmsteads).

For a survey dealing with schoolchildren, the stratum can thus be deemed to consist of all the schools (or classes) of a given category, and the substratum of all the pupils of the same school.

Points which it is essential to bear in mind in every case are that stratification presupposes the possession, for each sampling unit of the population, of the information necessary for its classification in the whole; requires that this

information be intact and (if there are more than two or three strata, file cards, dossiers, etc., will have to be sorted into strata); only improves the results of the survey in so far as there is real homogeneity in the strata.[1]

If the sampling units are classified according to the values of a known characteristic X, this stratification will improve the investigation of characteristics Y having a close correlation with X. Taking η to be used to denote the corresponding correlation ratio, the variance in the estimate of the mean value of Y may thereby be reduced by approximately 100 η^2 per cent.

JERZY NEYMAN'S THEOREM AND ITS EXTENSIONS

Neyman's thesis, published twenty years ago in the *Journal of the Royal Statistical Society*, was as it were the starting gun for mathematicians desirous of arriving at modern sampling methods at once scientific and practical. Neyman took a sample drawn by the Bernoulli method in each stratum of the population and, having decided in advance on the total size of the sample, sought to distribute it to best advantage between the strata, i.e. in such a way as to secure (for the entire population) estimates of minimum variance.[2]

He established that, to achieve this, sampling fractions should be adopted varying with the stratum and proportionate to the standard deviation of the characteristic studied in that stratum. In practice, accordingly, the wider the dispersal of the values of the characteristic studied in a given stratum, the larger the proportion of individuals which must be drawn from that stratum.

Neyman's discovery has had wide repercussions: the trend of research since then has been towards samples which no longer have anything representative about them in the strict sense. In essence, the use of adequate weighting co-efficients for each stratum is relied on to correct this and arrive at estimates which will be 'representative'. The original simplicity of the sample is thus being abandoned, to achieve more precision in the numerical results.

The same idea recurs in other theories, notably the theory of selection with unequal probabilities.

Neyman's theorem at once assumes a more complex form if the notion of cost be introduced. To assume a predetermined total numerical size of sample is one way of simplifying the problem of organizing a Bernoullian sampling by strata, in such a way as to secure minimum variance, the cost of the investigation being laid down in advance.

If the mean cost (per completed questionnaire) is the same in all strata, there will be a typical 'Neyman' problem to be solved. But it is often wiser to accept a variation in cost. For instance, in an investigation among heads of businesses, the stratum consisting of the heads of large undertakings can be reached without any interviewing process, by means of an ordinary questionnaire sent through the post; and the average cost will therefore be appreciably lower than for the stratum consisting of the heads of small undertakings, where a visit by an interviewer will be necessary.

The question is how to arrive at the optimum distribution, between the strata, no longer of the actual number of questionnaires but of the funds it is

[1] Homogeneity within each stratum, heterogeneity between the strata (the opposite of what is required in the sampling units).

[2] He confined himself to seeking an 'all strata' estimate, a linear function of the estimates of the individual strata.

proposed to devote to field work. By adapting Neyman's calculations, the optimum sampling fraction is found to be proportionate not merely to the standard deviation but also to the inverse of the square root of the cost per unit; thus it pays to increase the size of the sample considerably in the easily-sampled strata, and risk making a small reduction in it in the strata where the investigation is the most costly.

SELECTION WITH UNEQUAL PROBABILITIES

As long as the primary concern was to secure a 'representative sample', all the elements in the population had to be given the same chance of being included in the sample—in other words, selection with equal probabilities had to be arranged.

As theory progresses, the notion of the sampling element is absorbed and expanded into that of the sampling unit;[1] it is no longer persons only, but families, buildings, communes or farms which are drawn, and it is now that the use of unequal probabilities comes in.

By way of example, let us consider the following question set to farmers: As far as you yourself are concerned, are you in favour of reorganizing farm lands into compact holdings?

Here it is of interest to know not merely what proportion of the farmers reply in the affirmative but, even more, what acreage of agricultural land they represent; for it is possible that the positive replies may come mainly from large-scale farmers whose holdings are scattered (and accordingly unsuitable for tractor farming despite their size).

With a 'representative' sample of farmers (say, a Bernoullian sample), the extent of each one's holding being known, the proportion of the total agricultural land represented by the positive replies can of course be calculated; however, if the positive answers are few in number and represent large acreages, only a rough proportion can be arrived at, the sampling error being considerable.

But let us suppose that the sampling frame shows the size of each holding; it then becomes possible to give to each a number of chances of inclusion in the sample, proportionate to its acreage. Such a sample (non-representative and even systematically deficient in smaller holdings) will furnish directly an estimate at once unbiased and precise of the proportion of the total farm lands worked, that is, by those who favour land regrouping. On the other hand, to ascertain what proportion of the farmers favours such a measure, each reply would need to be weighted inversely to the acreage of the farm.

The surveys of the United States Bureau of the Census take place only in sample counties; Hansen and Hurwitz have shown the importance of giving each county a probability, proportionate to its size, of inclusion in the sample. In France, the INSEE follows the same procedure for the designation of the sample communes in their respective strata.

Let us consider the method's advantages in France. The communes are first of all stratified by regions, according to how rural or how industrialized they are, etc. Obviously this will yield samples which will be anything but representative, with the large communes too numerous compared to the

[1] The sampling unit is an element or cluster of elements; the element may be, specifically, a person.

small. Nevertheless, estimates free of bias can be drawn from such a sample (by weighting the data on each sample commune inversely to its size). Moreover, these estimates are more precise than with Bernoullian samples, the moment the strata comprise numerous small units and a few large ones only.

The fact is that there is considerable mutual resemblance between the small units, even between stratum and stratum, and it is useless to burden the sample with them; the large units, on the other hand, usually have extremely variable individual characteristics (beginning with their size), and this justifies their inclusion in large numbers in the sample.

To put it shortly, stratification of units by size is dispensed with, making it possible, for instance, to increase the number of regional strata; but it is accepted that the units representative of a region may sometimes be large and sometimes small.

MULTI-PHASE SAMPLING

One possible type of inquiry is one with an extensive phase, in which the sample is large and only a few simple questions, X, are put to it, and an intensive phase, in which part only of the previous sample is used and there is a much longer and much more difficult questionnaire, Y. If there is close correlation between certain of the X questions and the Y questions, it is possible to use the replies from the large sample to get a better result with the second phase of the sampling than could be obtained with two independent samplings.

For instance (case described by Neyman in 1938), the first phase may serve to stratify the large sample; after which, variable fractions of each stratum can be drawn by lot (to reduce the variance).

More generally, the first phase provides supplementary information for the second; one could use it to control the structure of the small sample or to arrive at an efficient estimator.

CHOICE OF ESTIMATOR

Mathematical theory has brought order and method into this essential question. It had long been observed that there were several ways of setting about an evaluation from partial data and that the results from these differed widely among themselves. It was known that some methods were better than others; but on occasion the statistician could be accused of making the figures say what suited him.

With a sample obtained by a mathematical procedure, these difficulties fade away. When no supplementary information is available, there is one linear unbiased estimate $\overline{X}$, and one only, for the true mean $\bar{x}$ of every characteristic X studied in the sample.

If supplementary information is available on the population sampled, this can be used for the calculation of other non-linear estimates $\overline{X}'$, $\overline{X}''$, etc., of the same quantity $\overline{X}$.

Of these, only those which are unbiased will be retained and from the latter the obvious course would be to retain the one with the smallest variance.

Thus, to choose between several estimates, the first step is to calculate

their mathematical expectations (and eliminate those which are biased); after which their variances would have to be calculated, or at any rate the one with the smallest variance identified.

To give an idea of the commonest estimators, the following examples will serve:

'A posteriori' Stratification

Suppose that to a question put to retailers and wholesalers in a Bernoullian sample of merchants the respective proportions of affirmative replies are the following:

retailers, 60 per cent; wholesalers, 25 per cent.

Suppose further that the population is known to consist as to 92 per cent of retailers and as to 8 per cent of wholesalers (supplementary information). Then the estimate reached from a posteriori stratification into wholesalers and retailers is, for all merchants, $0.92 \times 60 + 0.08 \times 25 = 57.2$ per cent.

If the sample of merchants consists, say, of 90 per cent retailers and 10 per cent wholesalers, the linear unbiased estimate is $0.90 \times 60 + 0.10 \times 25 = 55$ per cent.

This estimate is less good than the preceding estimate of 57.2 per cent (which inhibits a bias, but one small enough to be acceptable).

The precision of the estimate of 57.2 per cent is very close to what would be obtained from a true stratification with equal sampling fractions.

It is worth drawing attention to this point. If stratified sampling in equal fractions is in prospect, it may pay to adopt the procedure of a posteriori stratification (which avoids the necessity for preparing the frames for independent drawings by strata).

Ratio Estimation

Given the same data as in the preceding example and given that the merchants number 2,000,000, in this case the number of wholesalers who answered in the affirmative can be estimated as equalling either $2{,}000{,}000 \times 0.10 \times 0.25 = 50{,}000$ (linear unbiased estimate), or $2{,}000{,}000 \times 0.8 \times 0.25 = 40{,}000$ (estimate by ratio).

The second of the two estimates takes into account an item of supplementary information—'8 per cent of the traders are wholesalers'.

It will be noted that the a posteriori stratification formula is a combination of several ratio estimation formulae.

Ratio estimation involves a reduction of variance if the supplementary information takes into account a characteristic X in definite positive correlation with the characteristics Y under study; otherwise it increases the variance. It always involves a slight bias.[1]

[1] There are also formulae in existence for estimating by regression, the characteristics of which are absence of bias, and a gain in positive precision. However, the use of these formulae involves relatively lengthy calculations.

GENERAL PRINCIPLE ON THE USE OF SUPPLEMENTARY INFORMATION TO IMPROVE PRECISION

The whole theory of sample surveys is at present dominated by the notion of supplementary information.

Recourse to such information can be envisaged at various stages in the proceedings:

1. Right at the beginning, when the sampling frame is drawn up: the judicious choice of sampling units and the formation of efficient strata are dependent on the quality of the information available at that stage.
2. Later on, when the sample is drawn by lot: the choice between drawing with equal or unequal probabilities, the determination of the probabilities themselves and the control of the sample depend on supplementary information.
3. After the investigation, when the time comes to work out the results: without supplementary information it is always possible to extrapolate the results of the survey from the sample to the population; however, the method (while still correct) may lack precision, and it is then necessary to have supplementary information available to arrive at an estimating formula.

It will however be noted that only efficient items of information are of interest, that is, items relating to characteristics presenting marked correlations with those which it is sought to study. The complication of sampling and classification designs to take account of supplementary information of doubtful effectiveness is hardly to be recommended.

A point to note is that the use of items of information at one stage in a sample survey usually exhausts their interest, so that nothing much more would be gained by using them afresh at another stage. To simplify the calculations and to shorten the time lag between the actual field work and the securing of the results, it would accordingly be better to use the available items of information to improve the sample rather than to keep them back for estimating formulae.

Similarly, when the exact size of each sampling unit (for instance, communes) is known, it pays to sample them proportionately to their size rather than to form strata of units of comparable size; the latter procedure in fact involves a degree of loss in the transformation of quantitative into qualitative information. Against this, when the size of the sampling units is known only roughly, it may be better to utilize the information for stratification purposes.

The circumstance may arise of an excess of supplementary information, probably not all very effective, on the sampling units; the difficulty is to know where to draw the line.

For example, the investigator is sometimes faced with the choice between various stratification criteria without being able to increase the number of strata indefinitely. Thus, where a survey is to be made of 80 or so rural communes, stratification, by region, of size of commune (three sizes) and degree of 'countryfication' (four degrees) makes it impossible to consider more than seven large (and necessarily very heterogeneous) regions. On the other hand, with proportionate sampling of the communes according to size, as many as 20 regions can be distinguished. Or again, stratification by degree of 'countryfication' may be dispensed with and an estimator used, instead,

which corrects the results in function of the number of farm workers included in the samples.

MULTI-STAGE SAMPLING

Two-stage sampling was invented to reconcile the needs of practical life with the requirements of theory. It is of interest on two counts: it enables investigators to restrict their visits to a few hundred localities (instead of covering the whole of the country); it confines sample-drawing, and the need to be able to enumerate all the persons eligible for interrogation, to these localities.

To achieve this twofold and eminently desirable result, a definite increase in the variance of estimates—that is to say, a loss of precision—is accepted.

The principle of the method is simple. The first-stage units (in France, say, communes) and second-stage units (say, all adults) are first decided on. Next, a sample of first-stage units is drawn by lot, after which the final sample (of second-stage units) is drawn within the first-stage units.

There is nothing to prevent three- or four-degree samplings instead of two-stage ones. For instance, for the Bureau of the Census of the United States of America, the first-stage unit will be the county, the second-stage unit a minor administrative subdivision of it, the third-stage unit a small area traced on the map, the fourth-stage unit a dwelling in that area, and the fifth-stage unit an individual in that dwelling.

The variance of a multi-stage sample survey emerges as the sum of certain positive terms, each of which represents the random variations ascribable to one stage of sampling: for example, for INSEE sample surveys, variance between the sample communes plus variance between the individuals interrogated within the sample communes.

Used by itself, multi-stage sampling would thus produce results which were correct but lacked precision. Accordingly, it is always combined with other sampling methods.

The first-stage units are invariably stratified before random selection (incidentally, drawings are often with probabilities proportionate to the population of units). Thereafter it is a frequent practice to group the second-stage units into which the first-stage sample is divisible, or at least a large sample of these, in sub-strata (two-phase survey). It pays to use sampling fractions, variable from one stratum (or substratum) to another.

For an investigation on a national scale, two- or three-stage samplings in the countryside may further be combined with one- or two-stage samplings in the large towns (which are all included in the sample).

The result is a sampling design of the maximum complexity but giving superior results. The corresponding mathematical formulae are so long that it is preferable not to develop them. However, there are mechanical procedures (more particularly punched card systems) whereby the numerical results can readily be obtained.

THE FUNCTION OF COST AND THE GENERAL PRINCIPLE OF THE OPTIMUM SAMPLING DESIGN

In the end result, however great the complexity of the sampling design utilized, it is theoretically possible to express the variance $V(\overline{X})$ of the estimate $\overline{X}$ of an unknown magnitude $\bar{x}$ with the help of a function reflecting: certain magnitudes related to the structure of the population sampled (for instance, the numbers in the several strata, certain standard deviations, the coefficients of correlation, etc.); certain parameters defining the sample (that is to say, the sampling fractions or the numbers of the sample in the several strata, etc.).

Secondly, it is convenient to assume that the cost C of the survey and related operations can be expressed by a function: of certain magnitudes relating to the research resources and the nature of the work; of the parameters already mentioned defining the samples.

Of course, this assumption regarding C is only approximately true, the cost C being dependent, in fact, on numerous imponderables and thus having simultaneously the character of a variate and of a function. It is similarly impossible to arrive at a really exact expression of the function V.

Be that as it may, it is possible (in the absolute) to lay down the following principle. From a whole family of possible sampling designs, the optimum design is that which, for a given cost C, leads to a minimum variance V; the optimum design can likewise be defined as that which, for a given value of the variance V, involves a minimum cost C.

Thus the search for the optimum plan is reducible to a problem on classical lines to be worked by a system of equations with which, in simple cases, the parameters of the 'optimum' sampling designs can be effectively calculated, in so far as the numerical values of the magnitudes entering into the functions of variance V and cost C are known.

On the other hand, the extension of this principle to the determination (in the absolute) of the best sampling design of all those which could be thought of is impracticable, because the system of equations mentioned above can only be written down in so far as the functions V and C can be stated algebraically.

THEORETICAL DEVELOPMENTS

The foregoing outline is far from being exhaustive, and theory continues to evolve along various lines, of which the following are examples:

1. When several units are drawn from the same stratum, it may be desired never to draw the same unit twice; this is a classical problem in drawings with equal probabilities, but research (Henry, Hurwitz and Thompson, Yates and Grundy, Durbin, Midzuno) is still proceeding into the position when the probabilities are unequal.
2. The classical theory of the stratified sample presupposes independent drawings in each stratum, while the theory of the controlled sample relates only to a Bernoullian drawing. A problem still presenting difficulties is that of controlling the structure of a stratified sample drawn with unequal probabilities in each stratum (Goodmann and Kish).
3. An assumption of classical sampling theory is that the whole of the sample drawn by lot can be contacted. A design has been worked out squaring

more closely with the real conditions in which a fraction of the population is missed by the investigator at each visit. Variance is higher while the cost of the investigation becomes random (Birnbaum and Sirken).

Study and experiment have also been directed to a method of random selection of the times for contacting the sample units, reflecting the probability of the interviewer's reaching individual subjects (Politz and Simmons).

Lastly, over and above sample errors we have the errors—properly so called— committed by investigators; this raises questions which have been studied by Hansen, Hurwitz, Marks and Mauldin, Mahalanobis, Sukhatme, Deming, etc.

4. Neyman's theory gives the optimum distribution of a stratified sample taking only one variable into consideration. In practice, several variables enter in, which at once poses difficult problems. Neyman treats particular stratifications as premisses: in actual fact, the number of strata can be increased or reduced, which modifies the optimum distribution (Dalenius).

PART II

INFLUENCE OF MATHEMATICAL METHODS ON PUBLIC OPINION POLLS

It is worth beginning with a brief account of how public opinion was explored twenty-five years ago.

The opinion poll was already well developed in the United States of America, if not elsewhere; but interest would appear to have centred, in the main, on 'straw votes' whereby the results of elections could be forecast more or less accurately. As the uselessness of an investigation restricted to a few score or hundreds of individuals was realized, an endeavour was made to reach millions of electors.[1] However, a point overlooked was the need to ensure against distortion of the sample obtained; the existence of a law of large numbers was indeed grasped but perhaps too much relied on, since it never occurred to anyone that the fact of subjects being interrogated in large numbers was not in itself a guarantee and that it could, in fact, indirectly cause the gravest errors, by sacrificing quality to quantity. Blank voting papers (with a request for their completion and return) were sent out to people whose names had been taken from telephone directories or other yearbooks, without much reflection on the possibility that the members of the 'lower classes' whose names did not appear in the works of reference might vote quite otherwise than the persons who were so listed, and without consideration for the fact that only a small proportion of the people approached sent any reply.

Later—during the economic crisis of 1929-36—a transformation of the methods used took place, along lines fairly close to those followed by the

[1] Thus it would appear that in 1936 the *Literary Digest* sent out no less than 11 million blank forms, of which 3 million were returned.

mathematical sampling theories originally designed for the purposes of economic and social statistics rather than for surveys of opinion.[1] A point of interest, however, is that the success of the Gallup poll before the presidential election of 1936 was a weighty factor in the development of one particular type of opinion poll (the quota sampling).

To investigate the opinion or comportment of the public, survey organizations, official and private, today employ methods approximating more or less to the theoretical designs described in Part I. These methods themselves will first be described, after which an explanation will be given of the respects in which the simultaneous existence of several types of survey procedure appears warranted.

TYPES OF SURVEY PROCEDURE

The 'Quota' Survey

Under this procedure there is no 'drawing' of the sample in the strict sense, either because there is no suitable sampling frame or because it is preferred to dispense with it. The investigators themselves select the persons to interrogate. However, control of the structure is attempted by reference to various characteristics, for which there are statistics for the population being sampled (and of which it is sought to obtain an undistorted image); which are in obvious correlation with the characteristics under study in the investigation.

The characteristics most frequently used for control are: firstly, region and place of residence (large town, small town, countryside); secondly, sex, age (classification in five or six large age-groups) and profession (classification in about ten groups).

The first step is to enlist investigators residing in the various types of residential area in the several regions; for example, in Alsace, interviewers are needed in Strasbourg, in a medium-sized town, in two small urbanized localities, and in two or three rural communes—for the purposes, at least, of a survey of opinion covering the whole or a part of the population of all France (for a special investigation of Alsatian opinion, far more interviewers would be required). The localities could be selected mathematically; but it appears that generally they are simply picked in the light of the availability of interviewers, with an attempt, at the same time, to disperse the choices over the whole area of the several regions. From the latest census results for the Haut-Rhin and Bas-Rhin, it can be determined what should be the structure of the population by the four criteria of place of residence, sex, age and occupation.

It would even be feasible to use various combinations of the criteria (always excepting those of place of residence and occupation).

To arrive at the structure, say, of a 'representative' sample of 3,000 adults for the whole of France (30 million adults), the numbers shown in the last census are divided by 10,000, giving us the figure of 85 persons for Alsace, which is then distributed between the several interviewers. Lastly, each interviewer is advised of the number of persons he must interrogate and in what pro-

[1] The reader will be very well advised to refer to the paper read by Frederick F. Stephan before the twenty-fifth session of the International Statistical Institute (Washington) and reprinted in the *Journal of the American Statistical Association*, March 1948, p. 12-39.

portions between the sexes, age-groups and occupations. (These numbers are called quotas.)

For specialized investigation, it is advisable to adjust the choice of control characteristics accordingly. Thus, for an investigation in an exclusively rural section, different criteria would be used—for instance, the sample of self-employed agriculturists would be balanced by reference to the statistics on sizes and numbers of farms, on the numbers having a tractor, etc.

It is accordingly wise to make the most explicit reservations about the validity of the quotas by level of wealth used by certain market study organizations; it is doubtless easy to determine the levels A, B, C, and D from a combination of certain external signs of wealth, but it appears to be forgotten that there are no statistics available on the frequency of these external signs in the population, so that the quotas arrived at are more a judgment by the organization concerned than an objective picture of the population's actual structure.

Incidentally, the formation of a 'representative' sample is by no means an ineluctable necessity; for many investigations would, on the contrary, warrant the use of 1,000 working men, 1,000 intellectuals and 1,000 officials (each partial sample being rendered 'representative' in terms of its 'own' quotas) as the sample would be justified.

Precision of a quota survey. As the sample does not present the characteristics of a Bernoullian drawing, the corresponding variance formula is of course inapplicable.

Moreover, strictly, no formula based on the Calculus of Probabilities applies to a sample which does not meet the essential condition of affording every individual the chance of inclusion in terms of a particular law of probability. However, an idea of the precision of such a survey could be secured were it possible to calculate the variance of an analogous two-degree survey, deeming the communes where the investigators reside to have been drawn by lot within strata, and the sample of individuals to be interrogated to have been likewise drawn by lot. The fact that the composition of the sample is further managed by reference to sex, age and occupation should reduce the variance (in so far as the characteristic under study is in correlation with these three criteria). There is, however, little doubt that the freedom of action left to the investigator increases the variance, rather as though it were in a three-degree survey, i.e. one limited to the milieu in which the investigator operates. One can therefore only trust to luck that this 'third-stage' element will produce no bias—in other words, that the deviations traceable to each investigator offset one another; this is, in practice, what happens when the survey organization has achieved a shrewd balance of types in the membership of its investigating team.

Thus, constant confirmation must be sought by cross-checks (printings of newspapers, electoral statistics) that the samples being made up are free of systematic distortion (it must not be forgotten, for instance, that the Gallup organization in 1948 'fell down' over the exploration of the views of organized labour). Given this precaution, a degree of precision can be anticipated of about the same order as for a two-degree survey, that is to say less high than for a Bernoullian sampling from identical numbers.

On the other hand, for a survey restricted to the large towns a degree of precision should theoretically be secured not far off that of a Bernoullian

sampling if all of them are investigated, though a recent experiment[1] carried out in Great Britain seems to show that the precision would in reality be lower.

Randomization

This word designates sampling procedures which seek to imitate drawing by lot much more closely than is done by the quota sampling, while still dispensing with a sampling frame. Supposing a sample of n persons in a given commune to be wanted, the method consists in preventing the investigator from producing the systematic distortion of his sample which would arise if he interrogated the first people to hand. For instance, a zig-zag itinerary through the town is prescribed for him, with instructions to interrogate no more than one person every 500 metres (which avoids samples too closely grouped, with the 'cluster effect' produced by door-to-door inquiries).

He is directed not to confine his interviews to the street only (for in that case the sample would include too many idlers, delivery-men, street traders, etc.) but to call at homes as well; he must further make calls at meal times (or the sample would not include enough workers).

Again, he will be told the floors at which he is to call in buildings (otherwise, left to himself, he would automatically tend to go up as few floors as possible and most of the people questioned would be shopkeepers or concierges).

These methods seem very sound, if complicated; it may well be concluded that their use is a necessity when there is no sort of sampling frame available; for instance, for an investigation of the readers of a particular newspaper, the interviewer will approach people carrying it in the streets or in public transport but will need directives on the hours to choose, the places to visit, etc., so as to avoid any too obvious systematic bias of his sample.

On the other hand, when there is a frame, even an indifferent one, on the basis of which the sample can be drawn, there seems little doubt but that it should be utilized, the work of the interviewer being thereby often rendered simpler and distortions of the sample easier to avoid.

If 'randomization' was perfect, the precision of a one-degree survey would be the same by this procedure as with the Bernoullian sampling (with samples of identical size); in practice, however, it is likely to be less good, while there is a risk of the persistence of certain biases.

Random Selection from Registers or Lists

1. Let us take, as an example, a two-stage sampling design like those of INSEE in France. First and foremost, the sample of communes is drawn by lot from lists of relatively comparable communes (say, rural communes of a particular region, where more than 60 per cent of the population lives by agriculture). To give communes probabilities of selection proportionate to their population, the figures as returned at the last census are entered on the list and totalled cumulatively, and selected random numbers from one of the usual tables are taken from the column of cumulative totals. Thus the theoretical design is rigorously followed. In other countries, instead of communes there would be, say, parishes.

[1] Cf. *Journal of the Royal Statistical Society 1953*, IV. See A. Moser and A. Stuart, *An Experimental Study of Quota Sampling*, p. 349-405.

2. Thereafter the sample of 20 people per parish for questioning is drawn by selecting 20 names at random from the lists of inhabitants of the designated parishes. It is at this point that complications set in. The holding of a special census of all the inhabitants of the parish before the investigation is impracticable. One does not always have the luck to carry out a survey within a few months of a general census. Accordingly, the administration must be asked to supply the list or, in technical language, the sampling frame.

(a) In some countries (Italy, Netherlands, Germany) there are fairly up-to-date population registers or card-indexes which can serve as a sampling frame. At one time there were also registers of ration-card holders in most places, but in France at least this register was notorious for its largely fictional nature. In Great Britain, the electoral lists are held to provide a valid frame; in France, difficulties would arise were no allowance made for the fact that a high proportion of the population does not vote (foreigners, persons deprived of civil rights or making no effort to exercise them); in any case, it must be made certain that such lists have in fact been kept up-to-date (a process which is omitted in years when there are no elections in prospect); and finally, it will not be forgotten that youths between 18 and 21 years of age (who are excluded from electoral lists) often come within the purview of an investigation.

For specialized inquiries, the administration has registers (fairly readily accessible) which can sometimes be utilized. In France, the Agricultural Social Insurance list is used for surveys among farmers, and the register of wireless licences for investigations into listening habits.

(b) In the absence of nominal lists, use should be made of the lists or card indexes of habitations (or houses) to draw clusters of inhabitants. For such cluster sampling to be correct, the requisites in this case are that all the n persons in the cluster be interrogated (which is not always a very good procedure: correlation between the replies, influence of subjects on each other); or that one of the n persons be drawn by lot (which can be done in practice by a procedure devised by Kish) and his replies weighted by the number n.

Incidentally, it is easier to find a register or list of habitations than a list of persons. In most cases the rating authorities have such a list, though it may be incomplete as a result of various remissions in respect of, say, either the newest or the most antiquated dwelling. Where there is a cadastral register, the built-up plots could be used as units for the sampling. In France, INSEE utilizes its own housing census and supplements it by a sample of new buildings, but this postulates a system of quinquennial censuses and a high degree of stability of habitat.

With a register kept up-to-date, the population can be stratified. Thus, the Oxford University Institute of Statistics divides habitations into two strata in housing, according as the rating value (as shown in the register of ratable property) is over or under £130 sterling; for certain inquiries, Neyman's idea is followed of sampling in proportions five times greater from the higher housing stratum than from the other.

Area Sampling

At first sight it would be hard to conceive of anything more unlike the card-index method than 'area sampling', that is, sampling from the map; yet the ruling consideration is the same in both cases—to keep as closely as possible to the theoretical sampling design. The essential difference between the two is that, in area sampling, use is made of intermediate sampling units (comprising, say, five to ten habitations) circumscribed by a continuous line[1] on the map (in the countryside) or on the street plan (in towns or villages). In this way there is no longer any need for a list (often indifferent) of inhabitants of the commune to be supplied by somebody unconnected with the investigation; it is the investigator himself who prepares the necessary list, for the sample areas only, and it is thus brought up to date at each investigation —a second and even more material advantage.

The difficulties lie in the provision of maps and street plans for the service (a fairly high-cost item initially), in the technical training of the staff forming the area samples, in the lengthening of the field work and in higher transportation costs. As maps and street plans are frequently not available (or are not up to date), aerial photographs must often be substituted—which, in France at any rate, involves appreciable expense, more particularly if special flights have to be made for the purpose but also even if it is simply a matter of enlarging standard photographs.

CHOICE OF SAMPLING METHOD

Choice between Methods with and without Drawing by Lot

The procedures (quotas, randomization) whereby a sampling frame can be dispensed with are those most used; not only are they widely favoured by private public opinion research institutes, but they are regularly used by certain official bodies such as the National Opinion Research Centre (NORC) in the United States or the INED (Institut National d'Études Démographiques) in France. On the other hand, private bodies rarely turn to the procedure involving genuine random selection within frames, which have been developed by the official statistical services (United States of America, France) or by official bodies (Great Britain). The fact of these two types of method existing side by side may cause surprise and be thought to represent a temporary phase. It is clear enough how the situation arose: on the one hand, the private bodies for public opinion research did not wait for methods to be perfected to the greatest possible degree before starting work, while, on the other, only the official bodies had the means to equip themselves for the use of the most recent methods and the weight to secure access to official records. It is difficult for an interviewer accustomed to the quota method to submit to the discipline imposed on his colleagues of the other school; while the latter find themselves at sea when asked to follow the quota method. In the end result, it is awkward for a given organization to 'switch' methods according to the case, and it will rather resort automatically to that method for which it considers itself specially qualified though,

[1] Simplest example theoretically: a grid square on the map.

on three grounds at any rate, it is not always the most appropriate.

1. The drawing of samples by lot involves operations in the field which are relatively costly, whereas the resources available for public opinion surveys are often only exiguous; it thus becomes advantageous to seek (by the quota process) to keep expenses down, even at some sacrifice of quality in the results. The official sampling services are concerned primarily with questions of fact—for which accurate results are demanded—and only secondarily with inquiries into opinion, for which it is natural (and even economical) for them to use the same investigators and the same sampling bases as for the first type.
2. The procedures for random selection necessitate the employment of sampling frames not necessarily to be found ready-made, in which case their establishment if it is possible may involve expenses absolutely out of proportion with the other items in the costs of the investigations. A choice is thus presented either of not making the investigation or of conducting an investigation without a sampling frame.
3. The random selection procedures are only valid theoretically in so far as adequate data can be collected on all the units making up the sample. However, there is a whole section of the population difficult to contact, either because they are people who never answer letters sent them or because the interviewers (even if well-trained) never find them at home. In addition, another fraction of the subjects declines to answer (even with first-class interviewers). All in all, it is considered satisfactory when the 'short-fall' resulting from these phenomena remains at about 10 per cent, so that a real-life sample is never the sample as drawn.

   If the short-fall reaches 40 to 60 per cent, say, the position becomes completely impossible, the results of the survey being no longer anywhere near correct. Thus when the length or difficulty of a survey questionnaire or its indiscreet, even embarrassing, nature involves the risk of large-scale refusals to reply, random selection can no longer be regarded as a valid method, and should be rejected in favour of a quota method whereby the structure of the sample is controlled in terms of the essential criteria.

In the final analysis, a choice has to be made between two possible attitudes: either to take the view that an investigation without random selection (and accordingly with no security as to the results) is always too costly, more particularly if action is subsequently taken on the strength of an erroneous result; or to hold that, for certain matters in dispute, the results of an investigation, even if 'chancy', are still better than remaining in utter ignorance.

Apparently, sampling theorists tend rather to adopt the first attitude, and practising public opinion investigators the second.

The Choice between 'Quota' and 'Randomization' Methods

The principal development of the quota procedure has taken place since 1936, and it still remains the most frequently used survey method today. On the other hand, the 'randomization' procedures appear to be still little used, though Alfred Politz does employ them in the United States of America for market research. The reason is that, with the quota method, the interviewer (for whom surveys are often no more than a secondary occupation) can in

practice choose his sample from the people he has occasion to meet in the course of his main occupation or from his personal acquaintance; if he is paid according to the number of questionnaires completed, he can accept a modest rate per questionnaire. On the other hand, an interviewer working the 'randomization' procedure must devote several hours per day to seeking out the subjects he has to question; he must accordingly be paid by the hour, and thus the cost of the survey is raised.

Nevertheless, while the quota method is the cheaper of the two, it is not always possible to use it. In particular, to calculate the quotas certain basic statistics must be available.

For instance, for an investigation restricted to former pupils in *lycées* and *collèges*, there is first and foremost no satisfactory sampling frame available, since, in France at any rate, the majority of those eligible do not join Old Students' Societies. Nevertheless, if details on the level of education of the population are available from a recent census, it is possible to extract statistics on the current distribution, by occupation and place of residence, of former secondary school pupils; and from these the quotas to be passed to the investigators can be calculated.

But if the basic statistics are lacking, the determination of quotas is no longer possible and then, to prevent a sample selected anyhow from giving completely misleading results, it becomes necessary to have the interviewers practise some form of 'randomization'.

In conclusion, it would seem that there might be some advantage in combining, on occasion, the use of the two procedures.

Choice between Random Selection from Files and 'Area Sampling'

Random selection from lists or files is current practice in the *Social Survey in Great Britain* and the INSEE in France, though this is in no sense whatever a concerted policy. Both bodies, while perfectly abreast of the 'area sampling' methods which originated in the United States of America, have not held it necessary to imitate them; perhaps, also, they lacked the resources to do so, 'area sampling' having most of the marks of a 'luxury' method.

The truth probably is that, in the new countries, where population is highly mobile and building extremely rapid, it is difficult to keep official records up to date; there is a further possibility that the records in question are under the control of local authorities, which creates additional difficulties in a country organized on federal lines. But in Great Britain or Germany, on the other hand, there is little doubt that the administrative files furnish sound sampling frames at no cost.

France's position is not comparable in all respects with that of her neighbours; however, it so happens that INSEE has the task both of carrying out sample surveys and of maintaining certain basic records in conjunction with the major administrative departments which, for their part, were not hitherto very well equipped in this respect. For the rest, the use of the 'area sampling procedure' has not yet been finally rejected in France, and remains under review against the eventuality of the necessary funds and staff for making a beginning becoming available.

CONCLUSION

The methods of public opinion research have developed amazingly over the last twenty to twenty-five years. The old procedures—under which any sample was good provided it was large—are no longer considered valid today. The exceptional difficulty of an inquiry (such as Kinsey's) is no longer a sufficient excuse for deficiencies in the sampling design.

The new technical requirements have tended to bring about the abandonment of the postal inquiry and its replacement by the interview, which is more costly but makes it possible to secure a sample structure determined in advance —perhaps the most striking change; while, for inquiries into questions of fact, the combined and mutually complementary use of letters and interviews has spread to some extent.

The use of valid sampling methods has coincided with an extraordinary expansion of public opinion investigations; and the results of such surveys play an increasingly important part in the political life of our country.

II. *Research centres*

ACTIVITIES OF THE SOCIAL SCIENCE RESEARCH COUNCIL (NEW YORK) RELATING TO MATHEMATICAL METHODS IN SOCIAL SCIENCE

E. SIBLEY

The Social Science Research Council has long recognized the utility of mathematical methods in many fields of social science research, and has endeavoured both to foster the development of these methods and to make them more widely available to research workers by calling attention to desirable standards of training and by sponsoring training institutes in mathematics for social scientists.

In addition to its activities specifically directed to these ends, which will be described at greater length in this paper, the Council has, through its fellowship programmes, enabled many individuals trained in social science to secure advanced mathematical training or to develop and apply mathematical methods in their own research. Furthermore, many committees of the Council concerned primarily with planning or appraising research on particular substantive problems or fields of interest have incidentally devoted much attention to the applicability of mathematical techniques. Thus, for example, one of the four volumes on *Studies in Social Psychology in World War II* prepared by Samuel Stouffer and his associates under the auspices of a Council committee is devoted to quantitative methods of measurement and prediction. A complete review of the Council's various efforts to advance the development and use of quantitative and mathematical methods would have to include reference to some phases of the work of a very large number of committees which it has maintained from time to time during more than a quarter of a century. The rest of this paper will however touch only on activities primarily relating to mathematics and quantitative methodologies.

As early as 1932, a Council committee published in the *American Mathematical Monthly* a report entitled 'Collegiate Mathematics needed in the Social Sciences'. While the minimum standards recommended in that report have by this time gained general acceptance in theory if not in universal practice, the development of mathematical methods in social science has in the meantime advanced to a stage at which much more mathematical knowledge is required of anyone who would even read the current research literature.

A committee on scaling theory and technique, appointed in 1950 under chairmanship of Harold Gullicksen of Princeton University, is currently sponsoring the preparation of a technical monograph on the subject by Warren S. Torgerson. A bibliography of over four hundred titles has been assembled. Scaling methods in the past have been discussed in terms of experimental procedures, subject matter, stimulus characteristics, and type of response utilized, but none of these seemed adequate. In addition, no clear-cut rationale for distinguishing between scaling methods and such related fields as test theory, factor analysis, psychophysics, analysis of variance,

and bio-assay has been available. The organization finally adopted for the monograph is based on the theory underlying the different procedures, and deals with two fundamentally different approaches to assigning numbers to events on the basis of experimental data. These are the judgment approach, which is directed primarily toward the scaling of stimuli, the individuals or judges being convenient means; and the response approach, which attempts to determine simultaneously the scale values for individuals and the scale values for the stimuli.

In the summer of 1951 the Council supported a small inter-university research seminar on mathematical models for behaviour theory, attended by several psychologists and mathematicians. The seminar was held at Tufts College, 28 June to 24 August 1951. The senior members were: Cletus J. Burke, Indiana University; Robert R. Bush, now at Harvard University; William K. Estes, Indiana University; George A. Miller, now at Massachusetts Institute of Technology; Frederick Mosteller, Harvard University (chairman); David Zeaman, University of Connecticut.

Papers were written on the following topics:

1. A differential equation approach to a theory to be applied to discrimination experiments. It is hoped that this theory will be adequate to describe important aspects of operant conditioning, including response latencies.
2. The description of certain aspects of learning theory by linear operators.
3. A set-theoretic model attempting to translate contiguity theory into more mathematical terms, including treatments of spontaneous recovery and related phenomena, habituatory decrement and classical conditioning, and a study of reinforcement in terms of contiguity assumptions.
4. A statistical theory for simple verbal learning experiments.
5. A model for describing alternation phenomena. This model synthesized the main aspects of the curiosity drive and retroactive inhibition theories for explaining alternation phenomena.
6. A bibliography of previously published work on mathematical models in behaviour theory.

In the judgment of the members the seminar was extremely successful, for several reasons. First, the personnel was already interested in the main problem of the seminar and had a large backlog of problems waiting to be worked on. Little time was lost at the beginning of the session in ironing out communication problems or in debating value judgments. Second, most of the time was spent in actual research, the discussion sessions serving to contribute to its progress. Third, participants in the seminar found very early that most of them were attacking their main problems from points of view which had a common mathematical basis—thus results of one member could usually be translated into the language of another—and the translation itself was valuable since it provided another way of thinking about the same problem.

As a part of the Council's continuing interest in the improvement of training for research in the social sciences, particular attention has been given during the past two years to the mathematical prerequisites for research in social fields. Early in 1951 eight specialists were invited to prepare for the Council memoranda on the minimum mathematical background that might well be required of Ph.D. candidates in social anthropology, social psychology, and sociology. These memoranda showed a high degree of consensus as to topics that should be included in basic mathematics courses for students of

these sciences, but many obstacles besetting the development and offering of such courses.

For some time these problems had been under discussion by a joint Committee on the Mathematical Training of Social Scientists, independent of the Council, under the chairmanship of William G. Madow of the Department of Mathematics at the University of Illinois. This committee includes representatives of the American Anthropological Association, American Economic Association, American Educational Research Association, American Farm Economic Association, American Political Science Association, American Psychological Association, American Sociological Society, American Statistical Association, Econometric Society, Institute of Mathematical Statistics, Mathematical Association of America, and Psychometric Society. An informal inquiry from this group concerning the Council's interest in supporting a project for the improvement of the mathematical training of social scientists led to an invitation to its chairman to present a proposal for a summer seminar to develop materials for teaching the mathematics needed in research on social science problems. Production of a source book on mathematical methods for the social sciences was the ultimate objective. Specific plans for work during the summer of 1952 by a group under Mr. Madow's direction, at Dartmouth College, were subsequently developed with the assistance of S. S. Wilks of Princeton University, and approved for support by the Council.

In addition to Mr. Madow, the members of the group which met from 23 June to 23 August were: Oswald H. Brownlee, Department of Economics, University of Minnesota; David A. Grant, Department of Psychology, University of Wisconsin; George A. Miller and Robert Solow, Department of Economics and Social Science, Massachusetts Institute of Technology; E. William Noland, Department of Sociology, University of North Carolina; Howard Raiffa, Department of Mathematical Statistics, Columbia University.

In the words of the director of the group, the problem and source materials to be prepared during the summer 'were to be usable both by the mathematician who wishes to prepare courses to be taken by social scientists, and by the social scientist who wishes to see the mathematics that he should learn, and to have some help in learning it. The technique adopted is that of preparing sets of problems on single topics that begin at an elementary level and continue up to a point at which the results obtained are believed to be of direct interest to the social scientists in the area relating to the problem. Also, typical problems that apply to large numbers of social science areas are being abstracted and indications of the social science problems they include will be given. Finally, collateral materials, such as statements of the equivalents in mathematics of some social science phrases, of goals that a social scientist should try to attain, of possible course organizations, and of selected mathematical references, are to be included.'

Continuation of the work begun during the summer of 1952 has been taken over by the present Committee on Mathematical Training of Social Scientists which was appointed later in the same year with Mr. Madow as chairman. Other present members of the committee are Edward P. Hutchinson, University of Pennsylvania; Jacob Marschak, University of Chicago; George A. Miller, Massachusetts Institute of Technology, Frederick Mosteller, Harvard University, and Robert M. Thrall, University of Michigan. The committee has made arrangements for further preparation of teaching materials embodying the application of mathematics to social science problems. Although these materials

as a whole are not yet ready for publication, a monograph on difference equations for the use of social scientists, written by Samuel Goldberg of Oberlin College, is approaching this stage.

With funds granted by the Ford Foundation to the Council, the committee held a Summer Institute in Mathematics for Social Scientists at Dartmouth College, 22 June to 14 August 1953. The Institute was open to faculty members and pre-doctoral and post-doctoral students who wished to improve their mathematical training for the scientific study of human behaviour. In the selection of applicants, considerable reliance was placed on the maturity of students, and they were assumed to be well prepared in social science disciplines but not in mathematics. Previous training in the calculus was not required, but the work of students who had had such training naturally progressed more rapidly.

Two hundred and thirty-four applications for admission had been received in time for consideration, and the actual enrolment was about 40. Approximately one-third of those enrolled held doctoral degrees, while the majority were at various levels of graduate training. Disciplinary fields were represented in about the following proportions: psychology, 50 per cent; economics, 20 per cent; sociology, 20 per cent; others, 10 per cent.

The programme of the Institute was designed to equip students to: (a) formulate social science problems in mathematical form; (b) read mathematical literature in their chosen fields; and (c) do further work in mathematics and statistics beyond the level of the calculus if they found need for this in connexion with their work in social science.

No course in statistical methods was offered in the Institute. Each student pursued three courses meeting five days a week for eight weeks:

1. Mathematics for social scientists, 2 hours (sets, relations, probability, matrix theory, convex bodies, theory of games, linear programming, metric spaces, convergence, differentiation, integration).
2. Mathematical models in the social sciences, 1 hour.
3. Either (a) Advanced seminar on mathematical models or (b) More elementary mathematical topics, 1 hour.

Additional time was devoted to home work and reviewing subjects that had been discussed in classes, with the help of staff members. Thus each participant was expected to devote a minimum of six hours a day to the programme. No outside employment or research activities were permissible, as the intensive programme of the Institute required the exclusion of competing interests.

The teaching staff of the Institute included William G. Madow (Director), Professor of Mathematical Statistics, University of Illinois; Robert M. Thrall, Professor of Mathematics, University of Michigan; Robert R. Bush, Assistant Professor of Social Relations, Harvard University; and Howard Raiffa, Assistant Professor of Mathematical Statistics, Columbia University. Other visiting lecturers participated from time to time.

The Institute did not grant academic credits, but it is believed that the work of the Institute was equivalent to at least six semester hours of graduate or advanced undergraduate courses. No tuition or other fees were charged.

Study grants, ranging upward from $250 according to academic status and estimated needs, were awarded to a considerable proportion of those enrolled.

In selecting candidates for admission the subcommittee sought a group diversified by academic status, discipline, and geographical location, as the

purposes of the Institute included testing methods of instruction that may be adapted to the needs of both students at early stages of social science training and more mature social scientists whose previous mathematical training had been deficient. Preference was given to those who may be expected immediately or later to influence the development of curricula in institutions that train substantial numbers of social scientists.

Plans are now being made to hold two sessions of the summer institute in mathematics during the summer of 1955, one in a middle-western state and one on the Pacific coast, so that social scientists from other parts of the country may attend without excessive travel expense. On the basis of experience at the 1953 session it has been decided that two somewhat overlapping curricula will be offered at each session in 1955, one for students who have already studied the differential and integral calculus, and a less advanced programme for those without this background.

The summer training institutes represent a somewhat unusual type of activity on the part of the Council, which does not in general undertake to perform teaching functions normally carried on by universities. They are designed to test and demonstrate the feasibility of mathematical instruction adapted to the special needs of social scientists, and it is hoped that such instruction will gradually become a part of regular academic curricula. In fact, several universities have, within the last few years, introduced a few courses and seminars of this nature. The summer institutes may have best served their purpose if the time comes when they are no longer needed.

THE WATSON SCIENTIFIC COMPUTING LABORATORY

Columbia University, New York

The Watson Scientific Computing Laboratory at Columbia University is operated by the Department of Pure Science of the International Business Machines Corporation in collaboration with the University. It occupies the university buildings at 612 West 116th Street and at 612 West 115th Street.

The purpose of the Laboratory is research and instruction in the various branches of science, especially those involving applied mathematics and numerical calculation. The Laboratory works in close co-operation with the Subcommittee on Applied Mathematics in providing courses of instruction and assistance to students and research workers in this field. This instruction meets the needs of students interested in applying numerical methods to problems in the various fields of pure and applied science, and in the operation or design of large-scale calculating equipment. An important function of the Laboratory is to serve as a centre for the exchange of information concerning mathematical and machine methods and mathematical tables. The computing facilities of the Laboratory and special instruction are available to visiting scientists for basic research.

EQUIPMENT

The Laboratory is provided with a wide variety of calculating machines to permit not only the most efficient handling of a given problem but the comparative study of different methods. Included are standard keyboard machines, electric and electronic punched-card machines, as well as special calculators which operate by means of relay networks and electronic circuits. The following are the principal units.

Standard Electric and Electronic Punched-card Machines

A comprehensive selection of calculating punches and basic punched-card machines equipped with many special devices; a card-programmed electronic calculator which is a general purpose computer designed for sequential arithmetic operations, with a storage capacity of 450 digits, maximum input speed of 150 cards a minute, and printing speed of 150 lines a minute.

Relay Calculators

Two automatic calculators are available, with automatic plugboard sequence control, 30 registers of 6- to 12-digit capacity and facilities for consulting mathematical tables. They have provision for division and square root and each is capable of performing and recording 24,000 6 × 6 multiplications per hour.

Continuous Calculator

An electronic device for the solution of simultaneous linear equations up to and including the twelfth order.

Table Printing Device

This device reads numbers from punched cards and records them for printing by means of lithography or line cuts. It combines the reliability of punched-card operation with the flexibility and elegance of conventional printing.

Card-controlled Measuring and Recording Machine

An automatic machine designed primarily for the measurement of astronomical photographs. It locates the star image by means of co-ordinates in a punched card, measures its position, and records the measurement in the card. The punched card record is then available for mathematical treatment.

Keyboard Machines

Calculators, printing-adding machines.

Facilities for the construction of new equipment required by the Laboratory are available in the Department of Engineering of IBM and in the Laboratory itself.

IBM Type 701 Electronic Data-processing Machine

This large-scale electronic digital computer is available in New York City for use in scientific research. Cathode-ray tubes, magnetic drums and magnetic tapes, with a capacity of over 8 million digits, are utilized for storage. The memory capacity may be used interchangeably for numerical data and operating instructions, which permits complete flexibility in the elaboration of instructions by the machine itself. The fundamental machine cycle is 12 microseconds. Addition of 10-digit numbers can be completed in 60 microseconds, and the multiplication of over 2,000 10-digit numbers can be performed in one second.

LIBRARY

A technical library is maintained in the Laboratory. It is highly specialized in the field of activity of the Laboratory in view of the proximity of the extensive general libraries of the university.

INSTRUCTION

Members of the Laboratory staff offer courses of instruction in their fields of interest under the auspices of various departments of the university. Academic credit for these courses may be obtained by registering with the university in the usual manner and may be counted toward a university degree when approved by the department and the faculty concerned.

Instruction in the Laboratory is designed for graduate students and research workers in science. It is contemplated that many of those taking this instruction will be candidates for advanced degrees in the various departments of science in Columbia and other universities, and the instruction offered by the Laboratory staff constitutes part of the regular offering of the different departments.

Full descriptions of other courses involving applied mathematics which are offered by the several departments of the university are contained in the Announcements of the Faculty of Pure Science and of the School of Engineering.

THE IMPERIAL COLLEGE OF SCIENCE AND TECHNOLOGY

Prince Consort Road, South Kensington, London

By common consent, the Imperial College of Science and Technology is the premier British institution of university rank devoted to the study of science and technology. It traces its history back to 1845, and the College as it now is was incorporated by Royal Charter in 1907, to carry on the work of three existing colleges, and 'to give the highest specialized instruction and to provide the fullest equipment for the most advanced training and research in various branches of science especially in its application to industry'. It was the first institution recently nominated by HM Government as one which should be approximately doubled in size, in order to meet the increasing need for more technologists.

Imperial College has an independent governing body whose members are appointed by various bodies, including scientific and engineering institutions, but it is a School of the University of London. The main departments are aeronautics, biology, chemistry, chemical engineering, civil engineering, electrical engineering, mechanical engineering, geology, mathematics, metallurgy, meteorology, mining and physics. At present about two-thirds of the 1,700 full-time students are undergraduates, and about one-third are engaged in research or postgraduate study.

As the College has over 300 teaching staff, and over 500 research assistants and research students who are engaged wholly or largely in research, it is not possible in a short statement to give a comprehensive picture of all the research work being carried out or of the hopes based on it. This work leads each year to the publication in scientific journals, etc., of over 350 papers and reports. The following paragraphs refer particularly to the impact of the study of mathematics at the College on the social sciences.

There are two ways in which the work of the Mathematical Department impinges on the work of social scientists. On the one hand a great deal of the research concerned with, for example, the structure of matter—particularly metals—involves the discovery of new properties not hitherto exposed by experiment. Many of these find application in industrial practice. The result is that industrial changes frequently link up closely with mathematical discovery, and such industrial changes are obviously of importance to the social scientist.

It is mainly however in the statistical section of our department that the impact shows itself more directly. While the training of our students in the undergraduate stage in this field provides a basic course for economic statisticians, it is correct to say that the bias is mainly towards an analysis of the relative efficiencies of alternative industrial processes. It is true that the common pitfalls in handling published statistical data are examined and the fundamental processes of sampling, both for large and small samples, dealt with; and students also gain acquaintance with sources of economic and social statistics by the study of government and United Nations statistical digests. In addition they are introduced to the use of computing machines, including punched-card machines as used in census and social service work.

It is natural, however, that the direction of our studies should be closely related to the natural sciences and engineering, as in production engineering for example; though principles of costing are dealt with in relation to the economic design of experiments, and procedures are investigated that involve statistical decisions, again of importance to the social sciences. A good deal of the postgraduate work includes the theory and practice of special forms of sampling—as for example sequential tests, so designed as to extract at each stage the maximum amount of information from the sample taken. This is of importance both in the social and in the natural sciences—there are studies of reaction times and in aptitude tests. Nevertheless postgraduate students who wish to specialize directly in the social sciences are normally advised to attend the London School of Economics, unless their work promises to be predominantly mathematical.

Finally mention may be made of the fact that modern high speed computers are an essential tool in econometrics and in the type of economic planning known as 'linear programming'. We have designed and constructed a relay computer which is functioning, while an electronic computer now under construction in the computing section of the department is likely to be productive soon.

THE CARNEGIE INSTITUTE OF TECHNOLOGY

Pittsburgh, Pennsylvania

At the Carnegie Institute of Technology, a number of social science research programmes making extensive use of mathematical methods are being carried on in the Graduate School of Industrial Administration. The Graduate School, which was established five years ago with a generous endowment from the W. L. and May T. Mellon Foundation, conducts programmes leading to the master's degree in industrial administration, and to the doctor's degree in economics and in industrial administration. The research programme of the school is focused on the development of fundamental social science knowledge and the application of that knowledge to economics and management.

Research at the School in mathematical social science has followed two principal, closely related, channels. One of these takes as its starting point mathematical methods

that have originated in econometrics and in servo-mechanism engineering, and employs these in the study of rational decision-making and the construction of decision rules applicable to a wide range of management problems. The other main line of work focuses on the description and analysis of actual decision-making processes in organizations, takes social psychology and sociology as its starting points, and employs mathematical tools to construct abstract models of the processes that occur in organizational systems. Outside these two main areas, there are a number of other pieces of ongoing research, particularly in mathematical economics : the theories of the consumption function and of business investment, business cycle theory, and others.

Continuing team or individual projects concerned with the construction of rational decision rules include:

1. Development of linear programming techniques and their application to problems of production scheduling and control in multi-product firms. A report of part of this work has been published by John Wiley and Sons in *An Introduction to Linear Programming*, and more recent contributions have appeared in *Econometrica* (April 1954), *Journal of the Operations Research Society of America* (May 1953), the *Harvard Business Review* (May 1954), and elsewhere
2. Development of mathematical techniques for analysing the cost implications of operating decisions in dynamic systems (involving flows of materials and information) and the construction of decision rules for regulating production rates and inventories. A brief overview of this work has been published in the *Journal of the Operations Research Society of America* (August 1954), and further results will appear in a forthcoming issue of the *Journal of Management Science*.
3. Application of modern statistical techniques to business accounting and auditing procedures—reported in part in the *Journal of Accountancy*, March 1954.

These projects have had the dual aim of developing decision-making procedures of direct practical usefulness in business situations, and of contributing to the theory of rational decision-making. They have been guided by the viewpoint that a significant theory of rational choice must take account of the environment in which choice takes place—its complexity, the role of uncertainty about the future, and the inaccurate and approximate nature of the available facts. A reformulation of the theory of rational decision-making along these lines will be published in the *Quarterly Journal of Economics* (February 1955).

Research emphasizing 'actual' rather than 'optimal' decision processes has included the construction of mathematical models to aid in the analysis of (a) the mechanism of organizational survival and growth; (b) the employment relationship ; (c) the interrelationship of attitudes, communication processes, and influence processes in social groups. A portion of this work is surveyed in Chapter 8 of *Mathematical Thinking in the Social Sciences* (ed. by Paul Lazarsfeld) and in a forthcoming paper in the *Psychological Review*. Other investigations employing tools from mathematics and symbolic logic are concerned with the definition and measurement of influence.

Among the members of the faculty of the Graduate School of Industrial Administration who are working on mathematical social science are Professors A. Charnes, W. W. Cooper, R. M. Cyert, H. Guetzkow, C. C. Holt, R. E. Levitan, J. G. March, F. Modigliani, and H. A. Simon.

THE COMMITTEE ON MATHEMATICAL BIOLOGY

5741 Drexel Avenue, Chicago

OBJECTIVES

The Committee on Mathematical Biology is the enbodiment of the idea of a method-oriented approach to biological science as distinguished from the traditional subject-oriented approach. Mathematical biology centres around the application of the mathematico-deductive method to biological science and, by extension, to certain aspects of social science.

SCOPE

The Committee on Mathematical Biology has conducted investigations in the mathematical biophysics of cell metabolism, cell growth, and cell division; the mathematical biophysics of impulse formation and propagation in peripheral nerve; mathematical theories of psychological phenomena based on postulated structures of neural nets; the mathematical biophysics of the cardio-vascular system; mathematical theories of organic form, both structural and dynamic; chemical kinetics in models approaching biological structures; mathematical theories of radio-biology; mathematical ecology (dynamics of interaction between populations and environment or among populations); mathematical theories of mass behaviour; mathematics of small group structures; mathematics of historical processes and cultural dynamics.

Besides these there are other fields of mathematical biology such as mathematical genetics which have been extensively developed elsewhere.

ORGANIZATION AND PERSONNEL

At present the Committee on Mathematical Biology functions as a department of the University of Chicago and awards the Ph.D. degree in mathematical biology. On 1 July 1953 the staff comprised Nicolas Rashevsky, Ph.D., Professor and Chairman of the Committee on Mathematical Biology; Anatol Rapoport, Ph.D., Assistant Professor and Secretary of the Committee on Mathematical Biology; Herbert Daniel Landahl, Ph.D., Associate Professor of Mathematical Biology; Hyman Garshin Landau, Ph.D., Research Associate in Mathematical Biology (Assistant Professor); Alfonso Shimbel, Ph.D., Research Associate in Mathematical Biology (Assistant Professor); George Karreman, Ph.D., Research Associate in Mathematical Biology (Assistant Professor); Irvin Isenberg, Ph.D., Research Associate in Mathematical Biology (Assistant Professor); George William Schmidt, Ph.D., Research Associate in Mathematical Biology; David Lionel Cohn, A.B., Research Assistant in Mathematical Biology; Arthur Bierman, A.M., Research Assistant in Mathematical Biology; Albert Turner Reid, A.S., Research Assistant in Mathematical Biology; Peter H. Greene, A.B., Fellow in Mathematical Biology; Robert Irwin Macey, A.B., United States Public Health Service Fellow; Clifford S. Patlak, Ph.D., National Science Foundation Post-doctoral Research Fellow in Mathematical Biology; Lionel Israel Rebhun, S.M., United States Public Health Service Fellow; Ernesto Trucco, S.M., Fellow in Mathematical Biology.

PUBLICATIONS

The Bulletin of Mathematical Biophysics was founded as a quarterly in 1939 and is now issuing the sixteenth volume. Practically the entire output of the Committee is published in this journal. A growing interest in mathematical biology is indicated by the increase in the number of papers submitted to the journal from all parts of the world.

Several books and monographs have been published by members of the Committee on Mathematical Biology.

TRAINING

Although research in mathematical biology can be carried on by individual workers (as is evidenced by the extensive contributions of Helmholtz, Nernst, Volterra, Lotka, Kostitzin, Haldane, Fisher, Wright, Blair, Monier, and others), there is one function now performed by the Committee on Mathematical Biology which can be discharged only by it or by a similar organization, namely the training of mathematical biologists.

The early individual contributions to mathematical biology have come either from mathematicians and physicists, who have become interested in some 'mathematizable' aspect of a biological problem, or from biologists who have become convinced of the value of the mathematico-theoretical approach and have succeeded, frequently by a *tour de force*, in acquiring mathematical training as mature individuals. In recent years there have been attempts to launch 'interdisciplinary attacks' on biological and social problems by bringing together competent—sometimes even brilliant—workers in various special fields. Such attempts have not met with great success. In our opinion, this is due to the intellectual commitments of specialists to particular methods, terminologies and approaches, which make it extremely difficult for them to communicate with each other.

The Committee on Mathematical Biology is dedicated to the task of combining within single minds a biological and a physico-mathematical outlook. The difficulty of the task has not been underestimated. It is reflected in the exacting and rigorous curriculum of the training programme leading to the Ph.D. degree in mathematical biology. Normally the programme requires at least one more year of study than the average Ph.D. programme in any of the natural sciences. The requirements in the physical and biological sciences are about equal. The candidate must show complete grasp of methods and techniques of classical physics (mechanics, thermodynamics, electro-magnetism), of statistical physics, of organic and physical chemistry, and of quantum mechanics, of biochemistry, physiology, genetics, and embryology, and in addition, he must be versed in some specialized knowledge in a field of intended specialization (as reflected in the choice of thesis subject). For example, a candidate whose research problems are concerned with the mathematical theories of the central nervous system would need to have extensive knowledge of the proper mathematical techniques (such as the theory of probability) and of the factual aspects (such as neural anatomy). A candidate concerned with the cardio-vascular system would need special training in, say, hydrodynamics, elasticity, and plasticity, as well as the pertinent branches of anatomy and physiology.

PART II

ORGANIZATION IN THE SOCIAL SCIENCES
REVIEWS AND ANNOUNCEMENTS

THE

FOREV

The I
in Mi
Unite
The
ideas,
proble
dealin
facilita
The n
and w
the int
One
of rese
integra
in 195
actual

PEOPL

The c
the ph
aries. I
from r
greate
them.
Thes
opport
represe
pattern
and th
to put
stabilit
by prev
little o
such ci
Belie

I. ORGANIZATION IN THE SOCIAL SCIENCES

THE INTEGRATION OF MIGRANTS INTO THE LIFE OF THEIR COUNTRIES OF RESETTLEMENT

Observations and Practical Suggestions

FOREWORD

The International Conference of Non-governmental Organizations interested in Migration came into being in 1950, under the joint sponsorship of the United Nations and the International Labour Organisation.

The conference serves as an international forum for exchange of information, ideas, and experience among voluntary agencies concerned with migration problems. It works with governmental and intergovernmental organizations dealing with these problems, and also makes recommendations to them for facilitating the movement of migrants and their resettlement and integration. The motivation of the conference is the humanitarian concept of the dignity and worth of the individual. Its effectiveness depends to a large degree upon the interest and goodwill of people in local communities who share its concerns.

One of its principal concerns is the integration of migrants into their country of resettlement. The following statement on principles underlying successful integration has evolved from a resolution adopted at the Third Conference in 1952. No attempt has been made to present a technical paper showing actual practice and the ways and means of progress in integration.

PEOPLE ON THE MOVE

The complexities of life in the mid-twentieth century have brought about the phenomenon of the migration of millions of people across national boundaries. Many of these people are refugees and expellees fleeing from war and from religious, political and racial persecution. Many others are in search of greater opportunity or greater stability than life in their homelands affords them.

These millions of people on the move constitute both a problem and an opportunity for themselves and the rest of the world's population. They represent all types and all walks of life. While their experiences and cultural patterns may vary, they in common with all people have dignity and worth, and the capacity for growth and development. If, in moving, they find places to put down roots from which can develop wholesome lives, the world's stability will thereby be increased. If, however they are embittered not only by previous experiences, but also by poor reception in host nations, they have little opportunity to build and to contribute to their new homelands. Under such circumstances, they and the rest of the world will be the losers.

Believing in the essential value of these people and in the capacity of both

the migrants[1] and the people of countries of resettlement to meet the challenge of living constructively together, the Third International Conference of Non-governmental Organizations interested in Migration authorized the preparation of the present practical statement of the principles underlying the integration of migrants into the life of countries of resettlement.[2] The principles presented can most effectively be applied in planned migration schemes; however, they should be recognized as basic to the well-being of people in all migratory movements.

WHAT IS INTEGRATION?

The integration of migrants has been defined by the conference as the 'gradual process by which new residents become active participants in the economic, social, civic, cultural and spiritual affairs of a new homeland. It is a dynamic process in which values are enriched through mutual acquaintance, accommodation and understanding. It is a process in which both the migrants and their new compatriots find an opportunity to make their own distinctive contributions.'[3]

To achieve this goal of integration requires the joint efforts of men and women of goodwill, of all levels of government, and of voluntary citizens' groups, in addition to the positive efforts of the migrants themselves. Procedures which set the framework for the international movement of migrants rest, of course, with government. However, non-governmental agencies can do much to stimulate and support sound governmental policies as well to complement and supplement the services of government. Conditions will vary; in one situation custom and practice may decree that government carry the major burden, in another churches may give leadership; in still others trade unions or voluntary migration or social agencies may be the most effective agents; or groups of immigrants may work together for the common goal.

This paper does not attempt to decide where the main responsibilities for the integration of migrants rest, but supports the thesis that vision, understanding, strength, leadership and accomplishment are to be found at many levels and in many kinds of human association, and that the co-operative efforts of all those working towards integration are both desirable and necessary.

International organizations; national governments; departments of government such as labour, industry, immigration social, welfare and education, and subdivisions of government reaching into localities, have been and are contributing to the orderly movement and resettlement of peoples. Likewise churches, civic clubs, migration organizations, business groups, trade unions, social agencies, educational associations and citizens' groups have been and are active. These voluntary groups may be international in scope and membership or an informal citizens' group in a tiny South American village. For each, there can be a worthy purpose and a task, and for each, strong citizen and community interest and support are important.

The greatest power for effecting the integration of peoples is mutual understanding between migrants and established residents. The joint participation by natives and newcomers in the cultural, economic and religious life

[1] The word 'migrants' as used in this paper refers to people crossing national boundaries for resettlement.
[2] Document E/CN.5/274, United Nations Economic and Social Council, New York, 8 May 1952.
[3] ibid., Resolution IX.

of their communities can bring such understanding and a sense of the common dignity and worth. The use of mass media in furthering understanding is also important; the press, radio and television can all play their parts. Conferences, large and small, national, international and local are helpful, as is literature telling the story of human beings to other human beings. Programmes for the exchange of foreign visitors and students have also helped participating countries in the development of favourable attitudes. Integration is, however, a slow process, and those who would be helpful would do well to take the long view.

THE CREATION OF FAVOURABLE ATTITUDES

Favourable attitudes on the part of newcomers and old residents are so important in the integration process that interested governments, agencies and individuals will wish to give them special consideration. The shock of finding so much that is different and unexpected in the new country often affects the settlement of the migrant most adversely.

Before the actual immigration, a start can be made in helping migrants and hosts-to-be to understand the experiences awaiting them. Governments, voluntary agencies and the immigrants themselves can assemble information on the chosen country of resettlement. Immigrants can be helped, and can help themselves, to know something about the climate, geography, government, culture and industry of the country to which they are going before they set forth on the journey. With skilled technical help, realistic planning and preparation can be made for the daily life and employment to come. These processes, begun in the country of departure, will need to continue in the country of resettlement.

As the immigrant family prepares for immigration, the receiving country will need to prepare for reception. Practical knowledge is the first requisite for the people of receiving countries. Who are these people who are coming; why are they coming; what manner of people are they; what do they expect; what do they need; what can they give? Every means of interpretation will be needed to give such information to people in important places and neighbours who will live next door. The influence of the leading groups in any community can affect the acceptance or rejection of the migrants. Thus informed public opinion is essential, and continuous effort is needed to insure it.

After arrival the need for favourable attitudes will be subjected to the stress of everyday living. Gradually new and old neighbours can discover their similarities, differences and their relatedness. Newcomers are inevitably weighing their new environment, accepting eagerly some of its technology, accepting just as eagerly some of its values, accepting others more slowly but testing, testing, testing, and sometimes—perhaps rightly—rejecting. That testing process should not be discouraged; the values in it should be recognized, brought into the open and encouraged, if these newcomers are to be alert, intelligent and thinking citizens.

Migrants and permanent residents must he helped to understand that resettlement is a mutual process whereby each gains elements of new culture to add to their own. For the newcomers, knowledge of the language of the host country is essential. For new and old residents, personal contacts, both in work and play, can form the bridge to understanding. Simple neighbourliness

takes its place along with elaborate technical programmes in accomplishing integration.

Many countries of immigration have worked out plans to aid in this process. Governments of such receiving countries as Australia, Canada, France, Israel, Norway, and Sweden have developed a philosophy, programmes and practice to further resettlement. Voluntary agencies in many countries, especially in the United States, have supplemented government programmes or have led the way towards them. Literature and reports on programmes for the creation of favourable attitudes are available from numerous countries for the asking, or can be sought from the United Nations and its specialized agencies.

EDUCATION AS A TOOL FOR ADJUSTMENT

Both formal and informal education can be important factors in the adjustment of individuals and groups wherever they are. Educational opportunities should be available and made widely known to migrants, and utilized by those working and planning with them. All educational programmes should be directed toward the development of mutual acquaintance, understanding, appreciation and co-operation between migrants and the residents of receiving countries.

Many migrants are mature in their life experience, although unable to communicate in a language of their new country. The methods of instruction from the very beginning must therefore take into account their maturity. The receiving country will have the fullest return from its immigration programme only if opportunities for vocational and professional training equal to those of the native born are provided for immigrants. Formal educational opportunities for recently-arrived migrant young people should be provided within the regular framework of existing school systems, and in addition to any special short-term language and orientation classes. The subject matter of classes for or including migrants should be of wide range and at all levels of learning ordinarily available to local populations.

Perhaps the most important single element in integration is mastery of the language of the receiving country. All the other differences of custom, appearance, of social relationships or industry, pale before the barrier of language.

Plans for language training should provide classes or equivalent facilities for adults, old and young, women and men, and in rural areas as well as in cities and towns, at convenient times and accessible places, such as home and neighbourhood centres. The few basic words taught to the old by a friendly visitor can be as enriching as the speaking skill acquired by a child at play or school.

Migrants need especially to learn about community resources and customs, currency and transportation systems, methods of communication and shopping, insurance systems and labour practices. Finding the church or religious institution of his own faith and becoming a member of it may be the newcomer's first opportunity for identification with familiar and cherished values.

To further wholesome family relations, the educational experiences, formal and informal, of parents and children should be correlated so that parents and children can grow together into the life of their new country. One of the

difficulties in the family life of the migrant has often been the schism which develops between the adult migrant and his children, who more readily adopt the culture of the new homeland. With thoughtful planning such difficulties can be anticipated and often prevented.

The preparation of teachers and others involved in educational programmes should, of course, include instruction and orientation material on the cultural backgrounds of the newcomers, who in turn need to learn the cultural traditions and educational and recreational patterns, as well as the history and government, of their new country.

Voluntary organizations can be helpful in supplementing government educational programmes by providing special classes for migrants, individual tutoring, correspondence courses, university extension programmes, and instruction by audio-visual aids.

Visits to museums, libraries, and places of public interest also give a sense of belonging. Folk festivals, holiday celebrations, arts and crafts exhibits, demonstrations of culinary skills, dancing, musical, literary and dramatic programmes afford the opportunity for contributing to the community. The co-operation of the foreign born and native citizens in cultural and educational programmes is essential and enriches the experience of both.

As any nation or community grows in understanding of world affairs and of the languages and customs of other nations and becomes increasingly understanding and appreciative of the foreign born residents and the positive contributions they have to make, distrust begins to disappear, and migrants are recognized as co-workers and co-participants in community life, and as valued friends.

LEGAL FACTORS AFFECTING INTEGRATION

Migrants living under humane laws, justly administered, develop faith in the receiving country and respond positively. Laws applying impartially to citizens and non-citizens not only give the alien status in his own right, but also in the eyes of his citizen neighbour whose attitude is so important to his adjustment.

Whatever the laws, it is important for the migrant to understand them and to know his rights, privileges and obligations. If he is to make a good adjustment to his new life, he must abide by the laws of his chosen country. Because the immigrant may suffer from language handicaps and limited knowledge of the customs as well as the laws of the new country, he may need special assistance, including interpreters, social services and legal counsel, in dealing with his legal responsibilities. These services can be provided by governments, or by voluntary agencies working co-operatively with governments.

In many countries the laws especially affecting the status of aliens operate under administrative rather than court procedures. Where this is true, it is important that administrative decisions be subject to the same kind of judicial review as those operative in other administrative procedures of the country.

If he is permitted to immigrate the immigrant should be assured the right to work. Where licences are required for employment, provision must also be made for evaluating bona fide experience in equivalent terms so as to allow immigrants to qualify. Refugees who are unable to obtain original documents proving training or experience must be allowed to submit other forms of

evidence. In the case of immigrants no longer young, eligibility for licenses may need to be based on competence and the standards which prevailed at the time of their training rather than on current educational requirements.

Social security benefits are of great concern to immigrants, most of whom arrive in the countries of resettlement with minimum resources to protect themselves in time of disaster. Whatever protection is accorded citizens in regard to social security, health care and public assistance are equally necessary and desirable for newcomers. Some migrants leave behind them on departure, social security benefits which they have built up on over a period of years. Attention should be drawn to the provisions of the Convention on Maintenance of Migrants' Pension Rights, 1935, of the International Labour Organisation, which sets forth standards in this field,[1] and to the conclusions adopted by the Preliminary Migration Conference, in Geneva, 1950. It is to be hoped that as soon as practicable the United Nations, or nations acting bilaterally for themselves, will attempt the conclusion of international agreements under which transfers of such benefits can be made between nations.[2]

The General Principles Concerning the Protection of Migrants, adopted in 1951 by the International Conference of Non-governmental Organizations interested in Migration as a frame of reference in migration problems, states: 'No migrant, once admitted into a country, shall be expelled, deported or otherwise removed therefrom, unless such a measure is justified on grounds of public security and imposed by due process of law. Indigence, sickness or unemployment shall in no circumstances be regarded as sufficient grounds for such removal.' Deportation of lawfully admitted aliens should be carefully defined and limited. Otherwise, the shadow of fear will hang over the newcomer, immobilizing him in the process of integration.

The alien admitted to a country for permanent residence who can look forward to citizenship in his adopted country has a special impetus towards becoming a constructive member of the community. Such opportunity, clearly defined and regulated by law, should be available to aliens, but should not be compulsory or automatic. There should be no discrimination against naturalized citizens and they should be granted the same protection against loss of citizenship through acts committed or laws passed after acquisition of such citizenship as is granted to the native born.

Every country should be particularly alert to the protection needed by unaccompanied minor children who migrate from one country to another. Legal and social protection should he provided to investigate the wisdom of migration, the quality of the resettlement opportunity as related to the best interest of the child, and to ensure that the placement in the country of resettlement is supervised by a responsible agency which understands the needs of children.

THE TRAINING AND EMPLOYMENT OF MIGRANTS

Of primary concern to migrants are the employment opportunities in countries of immigration. Not only is livelihood at stake but vocational adjustment is

[1] *Handbook of International Measures for the Protection of Migrants and General Conditions To Be Observed in Their Settlement.* United Nations, N.Y. See pages 51, 91 and 175.

[2] The Italo-Brazilian Agreement on Emigration, 1950, provides that the two countries will study means of co-ordinating the existing social security legislation and systems in the two countries. Agreement has also been reached that British subjects emigrating to Australia may transfer their Social Security Accounts.

an important factor in the psychological and social well-being of the family unit.

Important services can be initiated in countries of departure for supplying accurate vocational information and evaluating the potential employment capacities of immigrants. Such services, if made truly accessible, can much reduce the hazards of immigration by eliminating persons whose vocational planning is unsound and unrealistic.

Both before and after arrival in the new country and if wise decisions are to be made, technical information must be available, expressed in standard terminology which can be understood both by migrants and receiving countries, as well as specific descriptions of job opportunities and information on skills and education required. Also important are understanding of the role of trade unions, the status of a given vocation, and the risks involved in the transfer of skills.

Transfer of skills from one work situation to another may create serious problems. For instance, a skilled European weaver may not find his skill usable in a highly mechanized weaving plant, nor, perhaps, in an undeveloped country. Special problems also face migrants in the professional categories, particularly as regard retraining and admission to practice in the professions, and here again, non-governmental agencies can be most helpful. Immigrants will wish to evaluate such factors as they move into new situations and will need skilled assistance in the evaluation of their own capacities and performance.

Many migrants finding their skills unusable in receiving countries may need new training or retraining to adapt their skills to new requirements. Others may find their first need and opportunity for vocational skill arising in their country of resettlement. Facilities for training and retraining are important for the proper use of manpower and are essential in giving immigrant workers and their families the chance of a full life.

The advisability of providing training in techniques used in the country of immigration is best determined by technicians. In some skills, it may be that retraining before arrival will be useful. In any event the training should be under the guidance of the receiving country to insure its applicability. In any training plan consideration must be given to adequate maintenance for the worker and his family during the training period.

Adequate facilities and services for finding appropriate employment are essential for resettlement. These facilities should be conveniently located, staffed with persons who understand the complexities of the transfer of customs, skills and practices, and geared to help in replacement as well as in original placement. Under some migration schemes first employment is arranged before migrants leave their home countries. In other situations placement is accomplished after arrival. Among the safeguards recognized in both plans are:

1. Realistic appraisal of the worker and the job opportunity should precede placement.
2. No worker should be recommended or compelled to fulfil any employment agreement (whether signed or otherwise arranged) when the wages or the conditions of work are substandard as compared with those prevailing for the country's own nationals.
3. No employer should be compelled to fulfil any employment agreement (whether signed or otherwise arranged) if the worker cannot meet to a reasonable extent the requirements of the job prevailing for the country's own nationals.

4. In case of employment difficulties, a responsible agency should be available to serve as liaison between the employer and the worker.
5. A responsible agency must be prepared to assist in finding alternative placement when needed.
6. Trade unions concerned should take part in the formulation of migration schemes, as regards advance assignment of workers and the proper placement of workers after arrival.

Sometimes in the effort to protect their families, migrant breadwinners go ahead to establish themselves in a new country while the families plan to follow later. Still more often receiving countries require that the worker precede his family. Experience shows that such planning has negative results for worker and family, and therefore, in turn, for the receiving country. The preservation of the family is so important for stability and adjustment that only in exceptional cases should even temporary separation of family units be considered.

Because of the nature of the problem as related to the economic life of receiving countries, primary responsibility for the vocational adjustments of migrants falls upon receiving governments. This emphasis on government responsibility does not imply that citizen interest and concern are unessential. Voluntary organizations can effectively supplement government programmes and on some occasions can and do act as agents of government. In some instances voluntary agencies may be the initiators of vocational programmes. Many voluntary agencies, particularly those engaged in international work, have accumulated considerable experience in the economic and vocational needs of migrants. This experience, acquired by their personnel, comprises a fund of technical assistance which can be drawn upon for many phases of migrant integration, including the vocational aspects. Without citizen interest governmental programmes cannot function with maximum effectiveness.

International organizations, trade unions and governments have accumulated, and are continuing to accumulate, information and experience in the vocational adjustment of migrants. Much has been done to identify basic principles, define and standardize areas of training and practice, and to assemble vocational data. Persons, agencies and governments concerned with this area of integration should have available for their use the findings of the International Labour Organisation,[1] the International Confederation of Free Trade Unions, and the experiences of labour, employment and governmental organizations in countries where resettlement has been successful.

WE WORK TOGETHER

Some of the principles underlying the successful integration of migrants have been set forth briefly in the preceding pages. A considerable body exists of more detailed information which will be useful to interested persons, agencies and governments, but unfortunately it is not assembled in any one place for the purpose of distribution. Direct requests to governments, trade unions, chambers of commerce and member agencies of the International Conference of Non-governmental Organizations interested in Migration will,

[1] Migration for Employment Convention (Revised) (no. 97), 1949; Migration for Employment Recommendation (Revised) (no. 86), 1949; Vocational Training (Adults) Recommendation (no. 88), 1950.

however, bring forth valuable material. The publications of the United Nations and its various organs are also valuable and are easily available.[1]

As a service to those interested in migration the International Conference of Non-governmental Organizations interested in Migration is undertaking to develop an information service. Requests for information can be made to the conference at 14 rue de Hollande, Geneva, Switzerland.[2]

The issues involved in successful migration and integration are among the paramount ones of our time. Redistribution of the world's population is taking place through gigantic upheavals as well as in orderly planned movement. The problems of migrants are the humanitarian concern of all peoples. All must work together to meet with informed intelligence the problems of millions of people on the move.

THE WORLD POPULATION CONFERENCE

Rome, 30 August-10 September 1954

The World Population Conference was organized by the United Nations in co-operation with the interested specialized agencies (including Unesco) and the International Union for the Scientific Study of Population (IUSSP). It was the first conference in this field officially sponsored by intergovernmental action.

Some 450 individual scholars from all parts of the world presented the results of their investigations and discussed problems in which they were interested in accordance with traditions of academic freedom. Invitations to the conference were issued, by direction of the Secretary-General of the United Nations, to persons nominated by international scientific organizations, governments, and the co-operating specialized agencies. Each government was limited to one, two, or three nominations (by population classes), except, as was often the case, where its nominees were also designated by non-governmental, international scientific organizations. Therefore, although nominations were received from more than 50 governments, a majority of the participants had been nominated by scientific organizations. No distinction was made with reference to type of nomination among the members of the conference; each had been invited in his individual capacity as an expert. It is, of course, understood that the word 'expert' is used here, as in current administrative parlance, in a technical sense—referring to a person assigned to some function on the basis of assumed competence and expected to act on his own responsibility rather than as the agent or representative of any government or institution.

The conference had been authorized by a resolution of the United Nations Economic and Social Council, 10 June 1952. This was in effect its charter. (It was subsequently revised in one detail, by action of the Council, to permit acceptance of an invitation by the Government of Italy that the conference be held in that country.) The first suggestion that a conference on population problems be organized by the United Nations came from Unesco. Action on this suggestion had been long postponed.

---

[1] Perhaps the most valuable single document available on the general subject of integration is the handbook published by the United Nations in 1953 entitled *Handbook of International Measures for Protection of Migrants and General Conditions to be observed in their Settlement*, International Documents Service, Columbia University Press, 1960 Broadway, New York 27, New York, $3. The International Labour Office also publishes articles concerning migration in its periodical *Industry and Labour*.
The office also welcomes material on this subject.

The question was again brought to the attention of the Population Commission pursuant to a letter from the President of the International Union for the Scientific Study of Population to the Secretary-General of the United Nations. The question was referred to Ecosoc by the Population Commission. An inquiry on this subject was addressed to member governments, the interested specialized agencies and scientific organizations, and replies were received before the Ecosoc resolution mentioned above was finally adopted.

The United Nations was assisted in making plans for the conference by a preparatory committee of scholars in this field, including some who also acted as representatives of the interested intergovernmental and non-governmental organizations [UN, FAO, IBRD, ILO, Unesco, WHO, IUSSP, ISI (International Statistical Institute) and IASI (Inter-American Statistical Institute)]. This committee held three meetings, in 1952, 1953, and 1954 (on the eve of the conference). These were supplemented by a lively exchange of correspondence. The UN Secretariat in its administrative decisions conformed with all the recommendations of the Preparatory Committee. Primary responsibility for the organization of each of the 31 meetings fell on one scholar, who as 'organizer', acted in co-operation with a subcommittee on organization. Members of the staff of four specialized agencies—FAO, IBRD, ILO, and Unesco—served as organizers. All the interested specialized agencies assisted in various ways, and contributed documentation.

The objectives of the conference were to promote exchange of ideas and experience among scholars from various parts of the world and from various disciplines concerned with population problems, and to bring these problems to the attention of the peoples and governments of the world. It was not designed to solve problems or to initiate action. In accordance with the Ecosoc resolution and on a recommendation of the Preparatory Committee, it was proposed that no substantive resolutions of any sort should be considered by the conference, and this proposal was included in the rules of procedure adopted in its formal organization. Professor L. Hersch, who, as President of the International Union for the Scientific Study of Population, was elected president of the conference, stated in his inaugural address that mounting recognition of the urgency of population problems throughout the world had increased the opportunities and responsibilities of scientists in this field and made it imperative that they call attention to the limits of scientific knowledge on these questions. Commenting on the wisdom of eschewing resolutions at this conference, he remarked that in matters of science a majority did not determine truth and that even a unanimous opinion might be erroneous. This remark was cited with approval at several points in the discussions.

The degree to which the objectives of the conference were achieved can not be easily estimated. Obviously the conference did bring together scholars from all parts of the world. The majority, as was expected, came from Europe (including both eastern and western countries) and North America. But members came also from such widely dispersed areas as the Andean highlands of South America, Australia, Indonesia and the Philippines, the Sudan, the Rhodesias, the Congo and the Gold Coast of Africa—with about ten members each from Brazil, Egypt, India and Japan. It is also apparent that the assembly included not only a goodly number of the most competent demographers, but also highly qualified economists, anthropologists, sociologists, public health officials, geneticists, psychologists and statisticians. The size and diversity of the assembly was due in part to the interest and prestige of the United Nations and its specialized agencies, and in part to the action of the International Union for the Scientific Study of Population in obtaining rather large financial contributions from sources in the United States, Italy, Brazil, India and France so as to extend assistance to many scholars who would otherwise have been unable to attend. About three-fourths of those invited actually attended the conference.

The topics treated included both issues of public interest and technical problems concerning concepts, methodology and procedures in obtaining and analysing demographic data. The series gives a fair picture of the nature and range of current population studies—except that only secondary emphasis was placed on problems of interest mainly to nations with advanced technology. Questions concerning the relation of

population trends to the economic and social development of countries undergoing industrialization, in recognition of their urgency, received special attention at this conference.

The size of the assembly, the scope of the programme and the large attendance at meetings had its disadvantages. There was only limited opportunity for informal personal and group discussions—chiefly during the noon recesses, evenings, and at the social events arranged by the Hospitality Committee. The same conditions also hampered discussion in the formal meetings. The prepared contributions had been circulated in advance, so that the discussions could proceed from summary reviews and statements of problems. The facilities provided (including those for interpretation) were excellent; the chairmen were magnificent; and most of the members took lively interest in the meetings and exercised great restraint in adhering to prescribed time limits. Nevertheless, the discussion, as members who had indicated interest in taking part were invited to speak, sometimes took the form of a succession of dissociated ideas. Yet many of the ideas thus presented were important contributions. Appraisal of the scientific value of the proceedings must be suspended until it is possible to study the published records.

It is impossible here to give any proper account of the substantive proceedings. The notes on this subject will be limited to three comments.

I. There was discussion on a wide range of important issues. A few such questions may be mentioned merely as illustrations. Does the recent rise in birth-rates in many western European countries and in the United States signify a real reversal (or at least an arrest) of the long decline of fertility—involving a rise (or at least constancy) in the average size of completed family—or is this merely a temporary phenomenon due in part to the completion of families previously checked by adverse conditions and in part to the effect of parents' starting families at earlier ages? This is an important question. There is some positive evidence of a rise in fertility, but there is still division of opinion on this subject among competent demographers. Is the economy of the Federal German Republic, as well as that of some other western European countries, capable of effectively using its present labour force and absorbing additions by immigration in the future? Some cogent evidence in support of an affirmative answer was presented at the conference.

Some of the meetings were related to various international studies recently completed or now under way. A meeting on problems relating to inaccuracies in basic demographic data was designed to facilitate the work now being done by a joint committee of the International Statistical Institute and the International Union for the Scientific Study of Population. The discussion on concepts and definitions was associated with the interlingual demographic dictionary project, which is being carried out under the suspices of the Union in co-operation with the United Nations. The texts of preliminary drafts in French, English, and Spanish were presented for examination and experimental use at the conference. The meeting dealing with research on relations between intelligence and fertility carried forward work initiated on this subject by a panel of experts under the auspices of Unesco; draft reports from this panel provided the basis for the discussion. Proof copies of the study now being published by Unesco on *Culture and Human Fertility: A Study of the Relation of Cultural Conditions to Fertility in Non-Industrial and Transitional Societies*, prepared under the auspices of the Union in co-operation with Unesco, were taken into account in the discussions on problems and methods of demographic studies in preliterate societies and on the social aspects of population changes.

II. There were four consecutive meetings on the demographic aspects of economic and social development, and topics treated in several other meetings were directly relevant to this subject. The comprehensive review of scientific findings on *The Determinants and Consequences of Population Trends*, recently published by the United Nations, provided a monumental background document for these discussions, and many important new contributions on various aspects of the subject were included in papers presented to the conference.

Anxiety about the effects of rapid natural increase on prospects for economic progress was expressed by participants from some of the areas most immediately affected, notably Egypt, India, and Japan, though such expressions were not limited to speakers from these countries. Optimistic statements about the prospects of economic advance going hand in hand with rapid natural increase were made by some participants from Latin American countries, but again such statements were not limited to persons from any one region. These contrasting attitudes were, in part, based on different conceptions of the relation of population trends to land and other natural resources. They also reflected different population-resource positions in various countries. These relations were treated analytically in the first two meetings of this series. The general tenor of these meetings was neither an easy optimism nor a stark pessimism. Much attention was given to the differential cost of alternative lines of progress under different circumstances.

Even more complex problems were treated in the third and fourth meetings of the series, connected with the relation of population trends to capital formation and the demographic aspects of developmental programmes in particular regions. It was recognized that there are many critical problems in the relation of rates of natural increase to capital formation, investment in education, etc., which are quite distinct from the question of the relation of population to natural resources. Types of demographic information needed in the development and execution of economic and social programmes were considered in the last of these meetings.

A number of leading Catholic laymen and priests took an active part in the conference. Some of their contributions were purely technical and did not involve ethical issues. Others at various points introduced moral considerations derived from Catholic doctrine. This was done clearly and with no indication of any tendency to disparage free scientific inquiries or to minimize the problems indicated by the findings of such studies. They recognized that a rational regulation of births must, eventually at least, be one aspect of man's economic, social and moral advance, though they insisted that this must be achieved through an enlightened moral will without resort to mechanical or chemical means of preventing procreation. In the course of the conference, there was explicit recognition by at least two highly qualified Catholic participants that the achievement of reasonable economic and social goals by underdeveloped nations, as conditioned by adherence to principles which these speakers accepted as moral obligations, would require greater sacrifices than might otherwise be called for, both on the part of nations now afflicted with widespread poverty and on the part of co-operating nations with greater financial resources. They were confident that true progress toward man's highest goals lay in following this course.

Clearly, questions about the relations of population trends to economic and social development involve some very complex associations and interactions. They also touch deep interests, anxieties and ideals. Unfortunately these questions have been befogged by ideological controversy. There were inevitably some echoes of this controversy in the conference. A few speakers presented extreme positions, which others repudiated as completely fallacious. In some cases, these were expositions of Malthusian doctrine. The doctrine of Malthus was frequently repudiated by members from communist countries. Their thesis was:

1. The fundamental cause of poverty must be *either* overpopulation *or* faulty economic and political institutions (this being usually assumed as a premise rather than explicitly stated).
2. Faulty institutions are a cause of poverty and institutional changes are needed to promote economic advance (a position with which most participants were in agreement, though not in many cases as regards the specific changes required).
3. Therefore questions about size of population or rates of natural increase are irrelevant to the issues of economic and social development.

In spite of the divergent attitudes and ideological positions already noted, the central tendency in the discussions was definitely toward an accurate, objective analysis of real issues and alternatives.

III. The meeting on the social aspects of population changes, of which Mrs. Alva Myrdal of Unesco was organizer and chairman, is of special interest to scholars in several of the social sciences. The material treated here was drawn from anthropology, sociology, psychology, demography, economics and history. Scholars from each of these fields participated in the discussion.

Attention was centred on the family as the focus of relations between social changes and population, with division into four topics: traditional family patterns in different cultures, especially in relatively stable societies; the impact of changes in economic and social conditions on the family, with special attention to societies undergoing industrialization; the changing western family; special research problems and techniques.

The importance of close collaboration between anthropologists and demographers in studies of the social organization and trends of various peoples was considered here in some detail, as it had been in an earlier meeting on demographic studies in preliterate societies. The importance of an analysis of basic cultural patterns for an accurate appraisal of processes of social change was also emphasized.

There was even greater stress on the need for international and interdisciplinary studies on the social aspects of changes brought about by new contacts, the introduction of new techniques and increased diversification of economic interests. It was recognized that orderly responses essential to progressive economic and social development might be thwarted by acute social disorganization. Several specific lines of approach to these problems were mentioned, including communication in general, and communication within the family in particular, the roles of persons in different situations in initiating change, and new leadership patterns. The emphasis on the need for co-operative studies came from consideration of the complexity of interacting factors in such situations. This is a field in which Unesco has already taken positive action, and it may be hoped that it will continue to do so.

Finally, the relation of changing family patterns to recent population trends in the western world seems to be equally complex. One participant stated that patterns of family life in the United States have been changing more rapidly during the last 15 years than ever before—in contrast to those observed in central Europe. But it is possible that the contrast here may be in part the result of differences in conceptual framework and research techniques. In this respect, the intimate relation of demographic analysis to other lines of social study is apparent. The value of findings from comparable investigations in different countries is hardly less evident.

Unfortunately no announcement can yet be made regarding arrangements for publication of the proceedings. The reader must, nevertheless, be referred to these proceedings, when they become available, for a proper account of the conference.

UNESCO'S PILOT SURVEY OF SOCIAL SCIENCE TERMINOLOGY

Instruction Regarding Definitions

Editors' Note

Complying with the resolution passed by the meeting of experts on social science terminology held in Paris from 5 to 7 May 1954,[1] Unesco has undertaken, in co-operation with national working parties established in Belgium, France and the United Kingdom, to define, in English and in French, about 150 scientific terms dealing with

[1] See *International Social Science Bulletin*, vol. VI, no. 3.

the study of the social consequences of technical change. The results of this experiment should show whether the project can be extended to all branches of the social sciences and to other languages.

We reproduce hereafter the text of the instructions regarding definitions circulated by Unesco for the guidance of the different national working parties during the pilot survey.

A. DECISIONS TAKEN BY THE COMMITTEE OF EXPERTS

1. *Choice of the type of vocabulary.* The general report drawn up after the meeting of experts on social science terminology, held on 5, 6 and 7 May 1954 (Document WS/064.47) lists the various possible types of vocabulary, namely:

An *encyclopaedia of social sciences* (similar to the *Encyclopaedia of Social Sciences* or the *Handwörterbuch* now being published under Dr. Schaeder's guidance);

A *vocabulary* (Lalande type);

A *general glossary* (with translations and equivalences);

and states that the committee decided in favour of the Lalande type of *vocabulary*, as it would be best adapted to (a) the aims Unesco has in view; (b) the resources of the various groups of social scientists concerned with terminology problems; (c) the methodological requirements of this type of work.

In the present pilot project stage of the work of the terminology committees, it seems premature to take an immediate decision on whether the object should be the preparation of a single social science dictionary or of separate dictionaries for each of the main branches of social science.

2. *Implications of the choice.* The experts considered the proposed work should be essentially a terminological dictionary containing definitions of the present concepts of social science and the social situation. Emphasis was placed on the term 'present' in order to restrict the experts' work to the definition of the most commonly accepted meanings in which terms are used in the scientific literature of the nineteenth and twentieth centuries and in current contemporary use. This idea of preparing a thoroughly modern dictionary of social science terms also implies that the definitions should be concrete and practical and calculated to facilitate understanding and analysis of our society, rather than abstract or purely formal. In addition, the committee stressed that the vocabulary should include no assessments of norms or judgments of values.

These features mean the exclusion of the following conceptions, which would be out of place in a terminological work dealing with the contemporary social situation: (a) the history of ideas or an account of systems of thought; (b) comments on the sociology of knowledge, logic and the epistemology of learning; (c) purely historical or geographical terms; (d) semantic studies; (e) biographies; (f) the drawing up of bibliographies in any form whatsoever.

3. *The languages of the pilot project.* At the present stage of the project, the funds put at the disposal of the Unesco Secretariat by the General Conference permit the granting of only very modest financial aid, confined to English- and French-speaking working parties. But it goes without saying that Unesco's ultimate aim is the preparation of one or several dictionaries of social science terminology in the various 'well-equipped' languages, together with multilingual lexicons giving the translations and equivalences of the terms defined in the other languages.

Meanwhile, the secretariat will put its technical experience and the documentation it has been able to collect on the subject at the disposal of the groups which may be, or have already been formed to examine the problems of terminology in languages other than English or French.

4. *The different stages of the pilot project.* Every language is the expression of a given culture and consequently contains a number of emotional and affective factors which

may profoundly alter the sense of etymologically similar terms. This is especially true for social science terms. It was therefore considered that it would be useful, as a first step, to instruct the English- and French-speaking groups to undertake the definition of the same terms, while working independently of one another.

A second stage of the project will consist in the comparison of the terms so defined and the scientific settlement of true equivalences of concepts and terms which most nearly correspond in meaning.

The results so obtained will, as soon as possible, be put at the disposal of the working parties dealing with other languages so as to enable them in their turn to establish equivalences of concepts and terms.

B. INSTRUCTIONS ON TERMINOLOGY

The general report of the meeting of experts also decided to proceed with the 'preparation of precise instructions concerning terminology' for the guidance of the different national working parties during the pilot survey. Such is precisely the purpose of this note.

It is of course obvious that these instructions, which are primarily designed to ensure some degree of uniform approach in the execution of the task and the presentation of definitions, must themselves be submitted to the test of experience. It will always be permissible for the national working parties, as their work proceeds, to ask the secretariat for additional or amended instructions designed to synthetize all their criticisms and comments.

In addition, it is only on the basis of this experiment that it will be possible to draw up definitive instructions on terminology, to serve as the foundation for social science dictionaries prepared in accordance with a standard plan.

1. *The preparation of the list of terms for the pilot survey.* In accordance with the decisions taken by the Committee of Experts (Item 8 in the minutes), a list of about 230 words was drawn up on the theme of the social implications of technical progress. The following works were used:

M. Mead. *Cultural Patterns and Technical Change;*

M. Edw. Opler. *Social Aspects of Technical Assistance in Operation;*

'Social Implications of Technical Changes.' *International Social Science Bulletin*, 1952.

All the above are Unesco publications, appearing in English and French.

This list does not pretend to include *all* the important terms dealing with the subject under study. Certain particularly complex terms have even been excluded in order not to complicate the task unduly. On the other hand, certain concepts have been included so as to complete 'word families' although they do not strictly fit in to the subject under examination.

The national working parties have, however, full freedom to add to this list and to draw up definitions of any terms which appear necessary to them for a proper understanding of those which are already included.

2. *Etymology.* The dictionary is not a work intended for philologists. Its etymological notes should, therefore, be as simple as possible and given in a few words (e.g. proletariat, from the Latin *proles*, race, descent). In exceptional cases, one or two lines may be devoted to it, if the etymology of a word sheds light on the present meaning of the scientific term.

3. *Historical meaning.* Nor is it the intention of the experts to give the semantic development of the terms defined. Nevertheless, it might be interesting to determine at what period, or in what system of thought, the word was first used in its present sense.

Conversely, the fact that the word is not to be found in works as typical, in the development of French thought, as the *Encyclopédie* (1751-1766) or is there given a meaning far removed from its present one, is of real importance for the social scientist.

In the same way, Garnier-Pagès' dictionary (1842) enables a clearer picture to be obtained of a vitally important period in the development of the political and social consciousness of the Continent.

The historic meaning can be illustrated by a quotation of two or three lines.

4. *Common usage.* The groups concerned with terminology will give, *if appropriate*, the generally accepted meaning as defined by the most up-to-date dictionaries and encyclopaedias in general use in the form of a definition as concise and objective as possible.

A quotation is not essential except where the working party thinks otherwise.

Terms of which the meaning is distorted chiefly for emotional reasons, or which are used—albeit widely—in a distinctly inaccurate or unjustified sense, e.g. the word 'race', as well as terms having controversial meanings, etc., will be distinguished by a diacritical mark (/w/). If necessary, a quotation will be given.

5. *Scientific meaning.* The commonest or the most valid meaning from a scientific angle is that which would result from a synthesis or the search for a 'common denominator' in different definitions. Such a definition, which must constitute the principal objective of the survey, would then be distinguished by means of an asterisk (*). One or two quotations will serve to illustrate this meaning.

In cases where it would be impossible to give one single meaning general enough to correspond to the usage of the majority of experts, or in others where the word is customarily used in two or more very different senses (each of which will be distinguished by a diacritical mark), the most commonly accepted meanings will be given.

The meanings appropriate to the different branches or to the chief tendencies *or schools* of the social sciences will also be given and illustrated by one or two short quotations of from two to five lines. The working parties will, however, try to keep the number of these meanings within bounds, limiting them to such as can help to introduce greater clarity and uniformity into the different branches. Wide deviations from the commonly accepted or general scientific meaning which might appear in one or another branch of the social sciences will be mentioned as such.

7. *Notes.* The systematic introduction of footnotes giving the opinion of members of the committees on terminology or inserting minority comments does not appear to be indicated.[1]

8. *The choice of authors quoted.* In principle, there is a wide choice of authors and quotations available. For present purposes, however, quotations from modern authors, whether alive or not, are preferable. The choice will depend on their topical significance, the extent of their contribution towards standardizing a generally accepted concept, the influence they wield in the modern world, etc.

This implies, in particular, that in the dictionary of French, or English, terminology, only those foreign writers whose works have been translated or whose systems have been outlined or commented on in Franch or in English will be quoted. The quotations will be given in the working language of each party.

9. *Wording of quotations.* The quotation will be followed by the name of the author and all information (title of the work, edition, volume, book, chapter, page, etc.) capable of helping experts in their research. The method of presenting and standardizing the references will not be decided on until a later stage of the undertaking, and, in any event, not until the pilot project is completed.

[1] Alongside the labours of the working parties on terminology, some of the fundamental terms used in the social sciences will be analysed in the form of articles by the best qualified experts and published in the form of independent opinions in the *International Social Science Bulletin.* The final settlement of such particularly intricate concepts will later be made the subject of international discussion groups in which experts from the various disciplines in the humanities and natural sciences will take part. This clarification of the most controversial concepts will obviate the introduction of too voluminous articles or notes into the dictionary.

C. PRACTICAL ARRANGEMENTS

While there is no desire to impose precise rules for the organization of their work on the different national committees on terminology, the following practical suggestions are nevertheless made in the light of experience and in the desire to preserve some uniformity of outlook:

1. *The organization of working parties.* In principle, every definition ought to be the result of collective work. Observations made in this connexion have led to the opinion that the simplest and most effective method of procedure is to entrust the preliminary drafting of the definition to a qualified research worker, who may be helped by students or assistants. The draft text is then submitted to all members of the working party, who are asked for their comments.

A smaller committee consisting of the most highly qualified experts in the social sciences should then proceed with a discussion of the draft, taking into account any comments sent to them and, if necessary, the opinions of experts on the subject.

The final editing of the definition would then be entrusted to the scientific secretariat of the working party.

2. *The role of the Unesco Secretariat.* The role of the secretariat, at this stage of the project, consists (1) of centralizing all information on the constitution of the various working parties, on the progress of their work, on the difficulties which have arisen and the questions raised during the experiment, etc; (b) to ensure, possibly in the form of additional instructions, the circulation of the decisions taken on the subject; (c) to arrange for the exchange and circulation of all information which might help the various working parties in their labours; (d) to attend to the publication of the definitions in the form of separate parts for each of the working languages, to serve as a basis for the meeting of experts provided for in the second stage of the pilot survey (cf. paragraph 4 of this paper).

2. *Cards.* To facilitate classification, interleaving and the handling of the definitions and also the constant expansion and improvements in the dictionary, the definitions will be issued in the form of cards of format 12 × 16 cm, typed on one side only.

A SURVEY OF THE INTERNATIONAL RESEARCH OFFICE ON SOCIAL CHANGE IN UNDERDEVELOPED COUNTRIES[1]

I. The Research Office, with the financial help of Unesco, has been able to undertake a survey whose character is both interdisciplinary and international. The objective is to establish a *critical* inventory and evaluation of the results of major items of research dealing with the problems of social change in the so-called underdeveloped countries. The survey will be directed towards the location of processes and models of change, the determination of the conditions most favourable to the use of quantitative methods of evaluation, and the examination of the adjustment of research work undertaken by various disciplines in the field of social and cultural change.

[1] Reprinted from 'Informations' no. 2, 1954, published by the International Research Office on Social Implications of Technical Change.

The interest of a survey of this kind is twofold. From a theoretical point of view, it represents a first attempt at a restatement of the question on the basis of the fundamental contributions which have been published up to recent years. It has a practical value in so far as a research project of this kind leads to a better understanding of the relationships which exist between socio-cultural change, technological progress, and economic development

II. The survey is organized on the basis of the material and efforts at theoretical elaboration found in the works classified under the headings: acculturation; contacts and cultural conflicts; economic developments and cultural change. Consequently it deals with the types of society called 'underdeveloped' to the extent that the latter are subjected to accelerated changes and conditioned (in varying degrees) by a set of exterior forces and to the extent also that the special problems of these societies are brought to the attention of research workers as much as to that of governments with special urgency. However, while it is easy to define the nature of the material to be studied by such a project, it is much less easy to define a priori the organization of the work. This difficulty is increased by the fact that it is impossible to impose any theory of social change at the beginning of the work. Such a theory can only be evolved in the light of the results obtained by the various research teams.

The major lines along which the work will proceed appear when the terms of the research project are recalled: an inventory and critical *evaluation obtained by an inter-disciplinary approach.*

1. There is a problem of terminology which can be explained by the more or less isolated development of research inside each of the various disciplines and each national school. Between specialists apparently identical terms and expressions do not always cover identical concepts. Notions such as that of 'crisis' (social crisis, economic crisis), of 'equilibrium point', of ' lack of balance', etc. do not always refer to the same system of concepts when they are used by different disciplines or by different national schools. An inventory of the terms originating from the study of socio-economic changes is a necessity and should endeavour to render the latter 'comparable' and to secure greater precision. Its objective should be to establish a common terminology as adequate as possible.
2. A problem of adjustment is in the forefront to the extent that different disciplines have not been able to advance at the same rate and to arrive at the same degree of elaboration. This question is particularly important because of the fact that research workers in the various disciplines have had too few opportunities for co-ordinating their work.
3. The problem of measurement also arises for, whatever may be the discipline undertaking an examination of the processes of change, an approach is necessary which makes numerical evaluation possible.

The division of the sectors of the inquiry renders possible a precise allocation among the five work teams and furnishes, at the same time, a logical progression.

The following 'steps' are planned:

1. Firstly, a methodical inventory making possible a real typology on the basis of the most important studies of socio-cultural change in 'underdeveloped' societies. This stage of the work implies the systematic examination of 250 to 300 books and articles. It implies the classification of data derived from examination (establishment of card indexes) and, on the basis of this work, the definition of the types of change with the indication as to their frequency. The indications regarding these types of change, their frequency and their grouping will also have to be related to the various types of society within which they occur.
2. In relation to the preceding investigation, and arising from it, is the need for a critical evaluation of the terminology used. It implies drawing up a list of the terms and expressions used, or created, by research workers in the field of socio-cultural change and establishes an inventory as exhaustive as possible of the meanings of each of them. This stage of the work should aim at achieving a relative unity and a precision which are indispensable for the progress of research.

3. Thirdly, comes the classification of 'models' in order to determine the most fitting level for a task for interdisciplinary research. The fact that the various disciplines have not been able to arrive at the same degree of conceptual elaboration has already been mentioned. It is therefore indispensable to classify the models which they have built in a hierarchical pattern progressing from lesser to more elaborate ones. A classification of this sort makes it possible to distinguish a kind of 'strategic' level at which the models defined by the different disciplines can be compared and put into relation with each other. This step is indispensable in order to avoid looking, as one could, for relationships between systems which, in fact, are radically heterogeneous.
4. A later stage concerns the problem of measurement which was mentioned earlier. The object should be to define the conditions which make measurement possible, to establish degrees of exactitude and to draw up significant series.
5. Finally, one of the research groups will be given the task of making a synthesis of the results obtained during the preceding stages of the work. The group will have to define the trends, the equilibrium points and the breaking points which emerge from a study of socio-economic change in underdeveloped societies.

In these particular cases economic development implies the 'passage' of models, techniques and objects proper to an industrial civilization into the framework of traditional civilizations which are only mechanized to a small extent. Moreover, this leads to an examination of: the variations which appear when a development determined from the 'inside' (endogenous) and a development determined from the 'outside' (exogenous) are compared; the consequences resulting from the passage of a technique or cultural model from a socio-cultural system, which has elaborated them to a system which is only receptive; the inevitable disequilibria which result from the transfer (of a model, tool or technique) from a system with a rapid rhythm of change (an industrial society) to a system with a slow rhythm (a traditional society).

These are the dominant questions which emerged from the work sessions of a meeting held from 1 to 6 March 1954. Evidently, there is no question of securing definitive conclusions in this field, but rather an assembling of the elements of replies and of reaching a level of synthesis superior to that which could be obtained by unco-ordinated researches and which the latter have been unable to achieve up to now.

III. The five national groups working in co-operation, on an interdisciplinary basis, were set up during July. They have already begun work on preliminary research and the working documents will be drawn up in final form in June or November 1955.

The five working groups have been set up as follows, on the basis of the five points to be examined: A group of the Institute of Social Studies (The Hague) under the direction of the Vice-Chancellor, Dr. B. H. M. Vlekke; a group of the Institut de Sociologie Solvay (Brussels) which includes Mr. S. Bernard and is directed by Professor H. Janne; a research group under the direction of Professor R. Firth, of the London School of Economics and Political Science and including Professor F. J. Fisher and Mr. D. G. MacRae; a research group including Professor Simon Kuznets (University of Pennsylvania), Professor Kingsley Davis (Columbia University) and Professor W. E. Moore (Princeton University); a group of the École Pratique des Hautes Études, VI[e] Section, Paris, in which Professor C. Levi-Strauss and Professor G. Balandier are collaborating.

A research project organized in this way can make an important contribution to the elaboration of a general theory of social change.

II. REVIEW OF DOCUMENTS, PERIODICALS AND BOOKS

DOCUMENTS AND PUBLICATIONS OF THE UNITED NATIONS AND THE SPECIALIZED AGENCIES[1]

UNITED NATIONS

GENERAL

Catalogue of Economic and Social Projects of the United Nations and the Specialized Agencies 1954. March 1954, 157 p., printed, $1.75. E/2555.
[Sc. Org. Pr.][2] Complete handbook, summing up systematically all the activities, studies and researches of the United Nations and specialized agencies in the economic and social fields. Covers permanent projects, projects finished in 1953, and projects included in the 1954 programme. The catalogue contains a note on each activity, indicating its aims, progress so far achieved, and relevant documentation. Index.

GENERAL ASSEMBLY

LEGAL QUESTIONS

Report of the 1953 Committee on International Criminal Jurisdiction, 27 July-20 August 1953. April 1954, 28 p., printed, $ .30. A/2645.
[Sc.] History and description of the committee's terms of reference. General principles of international criminal jurisdiction. Organization of an international criminal court; competence of the court; courts of first instance—criminal investigation; procedure of the court; pardons and conditional release, special tribunals. Annex containing a draft statute for an international criminal court. Index.

Sixth Report on the Regime of the High Seas. 22 March 1954, 32 p. A/CN.4/79.
[Sc.] Contains a definition of the high seas and draft articles, with commentaries relating to the freedom of the seas, merchant shipping on the high seas, naval vessels on the high seas, safety of navigation, submarine cables and pipelines, jurisdiction in respect of collisions on the high seas, policing of the high seas, fisheries—permanent or otherwise, pollution of the seas.

Nationality, including Statelessness. Observations from governments concerning a draft convention on the elimination of statelessness and a draft convention on the reduction of the number of cases of statelessness. 29 March 1954, 12 p. A/CN.4/82.
[Sc.] Contains observations on these drafts from the governments of Belgium, Costa Rica, Honduras, the Philippines and the United Kingdom.

---

[1] As a rule, we make no mention of publications and documents which are issued as it were automatically: regular administrative reports, minutes of meetings, etc. We have given a free translation of the titles of some publications and documents that we were unable to obtain in English in time.

[2] For explanation of abbreviations, see p. 728.

Nationality, including Statelessness. Report on multiple nationality, by Roberto Cordova, special rapporteur. 22 April 1954, 33 p. A/CN.4/83.
[Sc.] Introduction to the discussion by the International Law Commission on the elimination of multiple nationality and the reduction of the number of cases of multiple nationality.

REFUGEES

Report of the United Nations High Commissioner for Refugees to the General Assembly. 17 May 1954, 77 p. A/2648.
[Org. Pr. St. Ej.] Account of the progress made and the main difficulties encountered by the High Commissioner's Office. Points dealt with: activities of a general nature; legal aspects of international protection in different countries; groups of refugees in need of special assistance (refugee camps, difficult cases, refugees of European origin in China, United Nations Refugee Emergency Fund); efforts to find permanent solutions (repatriation and rehabilitation, economic integration, future programme designed to facilitate permanent solutions).

DEVELOPMENT OF NON-SELF-GOVERNING TERRITORIES

Development Plans in Non-self-governing Territories. A series of documents. A(AC.35/L.156 and various supplements.
[Sc. Pr. Ej. Dp. St.] The development programmes of the non-self-governing territories are summed up, compared and commented on in this series of reports, from the point of view of their aims, methods of financing them, the progress so far achieved, and the practical problems they raise. The countries concerned are the following: French West Africa and French Equatorial Africa, Madagascar, Morocco, Tunisia, the Gold Coast, Nigeria, Kenya, Uganda, Northern Rhodesia, Nyasaland, Cyprus, the Colombo Plan countries, those in other parts of Asia, in the Pacific region, the Caribbean Islands, etc. Similar information was published in 1950-51. This new series gives an idea of the progress achieved.

SOUTH-WEST AFRICA

Information and Documentation in respect of the Territory of South-West Africa. Part I. 11 May 1954, 483 p.
[Sc. Ej. St.] The Committee on South-West Africa, set up by a resolution of the Assembly, invited the Government of the Union of South Africa to accredit a representative to the committee and to resume the presentation of reports and the transmission of petitions concerning the territory of South-West Africa. In its reply, the Government of the Union of South Africa pointed out that it had never acknowledged an obligation to submit reports to any international organization since the liquidation of the League of Nations. The committee decided, therefore, to apply the procedure prescribed for such cases by the League of Nations.

For this reason, the report was prepared by the secretariat. It constitutes a reply to the first part of the questionnaire drawn up by the League of Nations Permanent Commission on Mandates, and bears on the following points: status of the territory, status of the native population, international relations, general administration, public finance, direct and indirect taxation, trade statistics, judiciary organization, police, defence of the territory, arms and munitions. Very complete information, statistics. Bibliography and indication of sources (Documents A/AC.73/L.3 and A/AC.73/L.3/Add.1).

Information and Documentation in respect of the Territory of South-West Africa. Part II. 11 May 1954, 376 p. A/AC.73/L.3/Add.1.
[Sc. Ej. St.] This document, a continuation of the previous one, constitutes a reply to the second part of the questionnaire drawn up by the League of Nations Permanent

Commission on Mandates and bears on the following points: social, moral and material condition of the native population; labour conditions and regulation; education; alcohol, spirituous liquors and narcotics; public health; landed property, forests; mines; population. Very complete information, statistics.

Information and Documentation in respect of the Territory of South-West Africa. Part III: Maps, 24 May 1954. A/AC.73/L.3/Add.2.
Maps of the territory in 1946 and 1952: administrative subdivisions, native reserves, hunting zones, diamantiferous regions, railways and principal towns.

Information and Documentation in respect of the Territory of South-West Africa. Addendum. 2 June 1954, 26 p. A/AC.73/L.3/Add.3.
Rectifications and corrections.

ECONOMIC AND SOCIAL COUNCIL[1]

ECONOMIC AND SOCIAL ACTIVITIES OF THE UNITED NATIONS

Financial Implications of Actions of the Council. Work programmes and costs of the economic and social activities of the United Nations. 31 March 1954, 48 p., E/2559; 8 April 1954, 2 tables, E/2559/Add.1; 29 April 1954, 4 p., E/2559/Add.2.
[Sc. Org.] Brief description of the progress made in all the economic and social programmes of the United Nations, by branch of activity. Add.1 is a statement showing the expenses relating to each activity. Add.2 shows recent changes. See also under 'General', Document E/2555.

1955 PROGRAMME

Calendar of Conferences for 1955. 14 May 1954, 9 p. E/2602.
[Org.] Meetings of the Economic and Social Council planned for 1955, also meetings of its principal organs (committees on public finance, population, etc.), and regional economic commissions, with indications opposite regarding the calendar of specialized agencies. Subject to change.

STATISTICS

Statistical Commission. Report of the Eighth Session (5 to 22 April 1954). 23 April 1954, 18 p. $ .20. E/2569.
[Pr. Org.] In previous reviews we have given an outline of the documentary notes prepared for this session, whose work is summarized in the present report: foreign trade statistics, indexes of wholesale prices, industrial statistics, distribution statistics, economic, social and cultural statistics of various kinds.

CAMPAIGN AGAINST PREJUDICE AND DISCRIMINATION

Advisability of calling a Conference of Non-governmental Organizations which are working to eliminate Prejudice and Discrimination. 20 May 1954, 32 p., E/2608; 6 July 1954, 5 p., E/2608/Add.1; 22 July 1954, 2 p., E/2608/Add.2.
[Pr. Org.] Analysis of opinions expressed by ILO, Unesco and 46 non-governmental organizations. The great majority of these opinions are in favour of calling a conference.

INFORMATION

Freedom of Information. Report of the Rapporteur on Freedom of Information. 28 April 1954, 11 p. E/2583.

[1] Including certain documents and publications emanating from other organs of the United Nations, but bearing directly on the sphere of the Economic and Social Council.

[Org.] Study of a special report by the Social Committee and draft resolutions concerning the transmission of news dispatches abroad, the status and freedom of movement of foreign correspondents, authors' rights, independence of news personnel, professional training, fees for professional training, press tariffs and priorities, international radio broadcasts, customs and trade practices, technical aid in the field of freedom of information.

STATUS OF WOMEN

Report of the Inter-American Commission of Women. 25 March 1954, 28 p., E/CN.6/249; 30 March 1954, 5 p., E/CN.6/249/Add.1.

[Ej. St. Pr. Dp.] In this report, the Inter-American Commission of Women gives an account of its recent activities and of changes that have occurred in the position of American women (North America and Latin America) in the political, civil, economic, social and cultural fields during the last few months. Statistics, map, brief bibliography. The addendum provides information on women's access to economic life in various countries of Latin America.

WORLD ECONOMIC SITUATION

World Economic Report, 1952-53. April 1954, 156 p. E/2560.

[Sc. Ej. Dp. St.] Sixth complete study of the world economic situation published by the United Nations. Analysis of the principal changes that have occurred in the economic situation of the different countries and in international payments between 1950 and 1953, and especially during the years 1952 and 1953. The first part of the report analyses the development of the economy of the different countries grouped in three broad categories: developed countries whose economy is based on private enterprise, countries with centralized planning, underdeveloped countries whose economy is based on private enterprise. The second part examines the changes that have occurred in trade and international payments.

ECONOMIC SITUATION OF AFRICA

Summary of Recent Economic Developments in Africa, 1952-53. 1954, 83 p., printed, $ .80. E/2582.

[Sc. Ej. Dp. St.] Supplement to the *World Economic Report, 1952-53* (E/2560 above). Analysis of the economic trends observed during 1952-53 on the African continent, not including Egypt, but including the islands along the African coasts, such as Madagascar.

Enlargement of the Exchange Economy in Tropical Africa. 12 March 1954, 59 p., printed, $ .40. E/2557.

[Sc. Pr. Ej. Dp.] Analysis of the structural modifications undergone by the native economies of tropical Africa on account of the ever more important part played by commercial production. This study illustrates with precise facts the development of the economic situation of the populations of this region: relative importance of the production of foodstuffs and of commercial goods, the nature of income-producing activities, trend of monetary incomes, origin and development of monetary needs, problems raised by economic development, land distribution.

ECONOMIC SITUATION OF LATIN AMERICA

Economic Survey of Latin America, 1951-52. 1954, 217 p., printed, $2.50. E/CN.12/291/Rev.2.

[Sc. Ej. Dp. St.] Fourth survey of this kind. In addition to the usual analysis of changes that have taken place during the period under review (1951-52), this report contains a first analysis of the economic production of Latin America, with a study of its factors and its rate of increase, as well as the level of consumption and the trend of investments in this region.

Economic Survey of Latin America, 1953. 1954, 246 p., printed, $2.50.
[Sc. Ej. Dp. St.] This study, the fifth of its kind, contains, in addition to the usual sections, chapters on problems not dealt with in previous studies—monetary questions, coal, etc.

Continues the analysis of the economic production, of consumption and investments in Latin America, begun in the study bearing on the years 1951-52.

ECONOMIC SITUATION OF THE MIDDLE EAST

Summary of Recent Economic Developments in the Middle East, 1952-53. May 1954, 128 p., $1.25. E/2581.
[Sc. Ej. Dp. St.] Supplement to the *World Economic Report, 1952-53* (E/2560 above). Examines the main trends observable during 1952-53 in the region comprising the following countries: Afghanistan, Saudi-Arabia, Egypt, Iraq, Iran, Israel, Hashemite Kingdom of Jordan, Lebanon, Sudan, Syria, Turkey, Yemen, Colony of Aden, Protectorate of Aden, Bahrein, Cyprus, Qatar, Kuwait, Muscat, Oman, Pirate Coast.

PRODUCTIVITY

Economic Development of Underdeveloped Countries. Working paper by the Secretary-General. 19 May 1954, 50 p. E/2604.
[Sc. Ej. Org.] State of United Nations activities in regard to productivity in industry in all its aspects, as determined by the various factors that enter into the operations of production: raw materials, fuel and energy consumed, fixed capital and labour. Summary of the work done by the United Nations for the improvement of productivity in industry, and of the technical assistance provided by the United Nations for the purpose of increasing that productivity, especially in the underdeveloped countries. (Extent of the programme of work; industries carried on in the home and handicrafts; problems of industrial productivity dealt with by Technical Assistance experts.)

PUBLIC ENTERPRISES

Report on the Seminar on Organization and Administration of Public Enterprises in the Industrial Field. 29 April 1954, 74 p. E/CN.11/1 and T/103.
[Sc. Pr. Fj. Dp.] The seminar took place in Rangoon in March 1954. It was attended by representatives from Burma, Cambodia, Ceylon, China, France, India, Japan, Pakistan and the United Kingdom, by observers from Israel and the Union of Soviet Socialist Republics, and by United Nations experts. The seminar examined present-day trends in the development of public enterprises in the industrial field in Asia and the Far East: their form, financing, staffing, and directors. Bibliography of the documents of the seminar.

ECONOMIC POLICIES OF THE VARIOUS COUNTRIES

Policies applied by the States in regard to Full Employment, Economic Development and Balance of Payments. A series of documents.
[Sc. Ej. St. Dp.] A questionnaire on full employment, balance of payments and trends in economic policy was sent by the Secretary-General to all the states, whether members or not, co-operating in the work of the regional economic commissions, as has been done every year since September 1952. This time, the inquiry relates to the years 1953 and 1954.

Generally speaking, each reply constitutes a fairly detailed description of the trend and results of the economic policy of the country concerned, more especially in regard to the labour market, the distribution and composition of the gross national product, measures designed to encourage economic development, to diminish inflationary tendencies and to regularize the balance of payments, etc.

The replies enable interesting comparisons to be made in respect of the situation

in the different countries, the practical attitude officially adopted by each country in regard to its economic situation, and the methods used in analysing it. However, as far as the objectives of economic development are concerned, the secretariat is not yet in a position to furnish a comparative analysis, as it has received too few replies from the underdeveloped countries.

The following are the main documents in this series:

Replies of Governments. 28 April 1954, 165 p. E/2565.
Explanation and text of the questionnaire. Replies from the governments of the following countries: Cambodia, Canada, Denmark, Haiti (reply to the first part), India (reply to the second part), New Zealand (reply concerning non-self-governing territories and trust territories), Panama (reply to the first part), Ukrainian Soviet Socialist Republic, Switzerland, Union of South Africa, United Kingdom.

Replies of Governments. Supplement 1. 18 May 1954, 191 p. E/2565/Add.1.
Continuation of replies: Australia, Byelorussian Soviet Socialist Republic, Ceylon (reply to the first part), Japan, Luxembourg, Netherlands, Rumania, Sweden, United Kingdom (non-self-governing territories and trust territories), United States of America (non-self-governing territories and trust territories).

Replies of Governments. Supplement 2. 24 May 1954, 119 p. E/2565/Add.2.
Continuation of replies: Brazil, Burma, Ethiopia, Poland, Yemen.

Replies of Governments. Supplement 3. 3 June 1954, 30 p. E/2565/Add.3.
Continuation of replies: Italy (statement concerning the trust territory of Somaliland), Norway.

Replies to Governments. Supplement 4. 18 June 1954, 51 p. E/2565/Add.4.
Continuation of replies: China (Formosa), Czechoslovakia, Hungary.

Replies of Governments. Supplement 5. 25 June 1954, 60 p. E/2565/Add.5.
Continuation of replies: Pakistan.

Replies of Governments. Supplement 6. 29 June 1954, 32 p. E/2565/Add.6.
Continuation of replies: Finland, Laos.

Replies of Governments. Supplement 7. 30 June 1954, 15 p. E/2565/Add.7.
Continuation of replies: Austria.

Replies of Governments. Supplement 8. 9 July 1954, 43 p. E/2565/Add.8.
Continuation of replies: Belgium. Since 1950 the Belgian Government has been sending regular reports to the Economic and Social Council regarding the implementation of Council resolutions on full employment. The Belgian Government's position in the matter of full employment was explained in previous reports. The present reply merely mentions the changes made in October 1953 in the social legislation, with particular reference to the system of unemployment insurance.

Replies of Governments. Supplement 9. 8 July 1954, 70 p. E/2565/Add.9.
Continuation of replies: France, India (replies to the first part).

Analysis of Replies of Governments to the Questionnaire on Full Employment, Economic Development, the Balance of Payments, and Economic Trends, Objectives and Policies in 1953 and 1954. 14 June 1954, 30 p., E/2620; 21 June 1954, 30 p., E/2620/Add.1.
[Sc. Ej. Dp.] Comparative analysis of the trends and prospects apparent in the replies reproduced in Documents E/2625 and the facts given in Documents E/2563, E/2564 and A/2646, mentioned elsewhere in this review.

MEASURES TO PREVENT POSSIBLE INFLATION AT HIGH LEVEL PERIODS OF ECONOMIC ACTIVITY

Steps to be taken to avoid the Inflation that may be caused by a High Degree of Economic Activity

A series of documents.

[Sc. Ej. Dp. St. Pr.] The Secretary-General, in a note dated 10 August 1953, suggested to Member States that governments with experience of measures to counteract inflationary tendencies due to a high level of economic activity, or to the process of economic development in underdeveloped countries, might give the Council the benefit of their experience by presenting written statements on the subject. In many cases the replies contain detailed analyses of the economic conditions peculiar to the country concerned and, in some cases, they mention factors in economic disequilibrium and steps taken to restore economic equilibrium.

The main documents in this series are:

Replies of Governments. 6 April 1954, 125 p. E/2563.
Text of the resolution and replies of the governments of the following countries: Australia, Belgium, Canada, Chile, Colombia, Czechoslovakia, Denmark, El Salvador, Honduras, India, Iran, Luxembourg, Netherlands, New Zealand, Pakistan, Poland, Syria, Turkey, United Kingdom, Union of South Africa.

Replies of Governments. Supplement 1. 22 April 1954, 55 p. E/2563/Add.1.
France (French Union), Sweden, United States of America.

Replies of Governments. Supplement 2. 10 May 1954, 14 p. E/2563/Add.2.
Norway.

Replies of Governments. Supplement 3. 10 June 1954, 14 p. E/2563/Add.3.
Burma, China: Formosa.

Summary of replies. 12 May 1954, 16 p. E/2597.
Summary of all the replies contained in document E/2563 and its supplements. The replies of Czechoslovakia, Denmark, Luxembourg, Poland and Syria, which contain no detailed information, are merely mentioned. The document is divided into two parts, dealing with the industrialized countries and the economically underdeveloped countries respectively.

RECONSTITUTION OF A PEACE ECONOMY

Reconversion after the Rearmament Period

[Sc. Dp. Ej. St. Pr.] In compliance with Resolution 483(XVI) of the Council, relating to full employment, the Secretary-General, on 10 August 1953, sent a note to all Member States asking them to inform him of their opinions on the measures they considered necessary to prevent reductions in defence expenditures from having adverse effects on their own economy and on that of other Member States.

The governments' replies to this inquiry constitute a series of documents, including the following:

Replies of Governments. 14 April 1954, 40 p. E/2564.
Text of the resolution and replies from the governments of the following countries: Australia, Belgium, Canada, Colombia, Denmark, Egypt, France and the French Union, Honduras, Iran, Netherlands, New Zealand, Poland, Sweden, Thailand, Turkey, Union of South Africa, Union of Soviet Socialist Republics, United Kingdom, United States of America.

Replies of Governments. Supplement 1. 20 May 1954, 5 p. E/2564/Add.1.
Yugoslavia.

Replies of Governments. Supplement 2. 8 June 1954, 6 p. E/2564/Add.2.
Burma, Norway, Pakistan.

COMMODITIES

Review of International Commodity Problems, 1953. 94 p., printed, $1. E/2578.
[Sc. St. Dp. Ej. Org.] This review, prepared by the Interim Co-ordinating Committee for International Commodity Arrangements, contains a summary of events in 1953 concerning the marketing of commodities, intergovernmental action in this field, important agreements, monographs on wheat, coal, the principal metals, cocoa, coffee, cotton, fats and oils, timber, leather, jute, rice, rubber, silk, sugar, sulphur, tea, tobacco, wool.

INTERNATIONAL FINANCING OF ECONOMIC DEVELOPMENT

Special United Nations Fund for Economic Development
Comments of Governments on the Report of the Committee of Nine. May 1954, 67 p., A/2647/7; 25 May 1954, 18 p., A/2646/Add.1; 23 July 1954. 38 p., A/2646/Add.2.
[Sc. Pr. Dp. Ej. St.] The United Nations is examining the possibility of setting up a special fund for the grant of subventions and of long-term, low-interest loans to underdeveloped countries, with a view to helping them to speed up their economic development and to finance non-amortizable projects essential to that development.

A committee, known as the 'Committee of Nine', has prepared a detailed plan for this project. The plan was published in 1953 in the form of a brochure, which we have already mentioned (E/2381).

Governments were asked to express their opinions on the usefulness of the plan and on the moral and material support they would be prepared to give to the proposed fund.

The above documents, A/2646 and supplements, contain the texts of the replies already received from 33 governments.

Economic Development of Underdeveloped Countries. Establishment of a Special Fund for Grants-in-aid and for Low-interest, Long-term Loans. Interim report submitted by Raymond Scheyven. 13 May 1954, 8 p. E/2599.
[Sc. Pr. Ej.] Mr. Scheyven was responsible for examining the replies of the governments. He also undertook an inquiry in various capitals. His report constitutes a broad exposition of the question of international financing of economic development.

Question of establishing a Special Fund for Grants-in-aid and for Low-interest, Long-term Loans. Co-ordination between the Activities of a Special UN Fund, the TAB and Certain Specialized Agencies. 9 June 1954, 12 p. E/2618.
[Org. Sc.] Problems raised by co-ordination between the activities of the proposed special fund and of agencies such as the International Bank, the International Monetary Fund and the TAB.

Report on the International Bank for Reconstruction and Development on the Question of creating an International Finance Corporation. 9 June 1954, 12 p. E/2616.
[Sc. Pr.] During recent months the Bank has continued its study of this question, in consultation with the competent authorities in different countries, especially in those countries that export capital.

INDUSTRIALIZATION

Bibliography on the Processes and Problems of Industrialization in Underdeveloped Countries. 29 March 1954, 76 p. E/2538.
[Sc.] Part I: Publication by the UN and the specialized agencies on the industrialization of the underdeveloped countries (in the wide sense of the term). Part II: Books and documents from all quarters dealing with the industrialization of the underdeveloped

countries (in a narrower sense of the term: development of manufacturing industry). The references are divided into two categories: works not confined to any region or country, and works relating to a particular region or country. Australia, Japan and the Union of Soviet Socialist Republics, where industrialization has advanced rapidly in recent years, are amongst the countries under review. Several hundreds of references.

TRANSPORT

General Agreement on Economic Regulations for International Road Transport. 22 March 1954, 38 p., $ .50. Bilingual text: English and French. E/ECE/186.
[Pr.] Text of the agreement signed in Geneva on 17 March 1951 by 12 European countries, annexes relating to the technical details of its implementation.

TOURISM

United Nations Conference on Customs Formalities for the Temporary Importation of Private Road Motor Vehicles and for Tourism. Final Act. 7 June 1954, 11 p. E/Conf.16/19.
[Sc. Pr.] This conference, which took place in May 1954, was attended by representatives from some sixty countries and various international organizations. It drew up legal texts on customs facilities for tourism and on the temporary importation of motor vehicles.

WATER RESOURCES

Development and Utilization of Water Resources. 18 May 1954, 20 p. E/2603.
[Pr. Org.] General analysis of the present situation on the basis of a study of the action undertaken by the UN and the other interested international organizations in regard to a coherent and rapid development of water resources.

HOUSING IN ASIA

Report of the Inter-Secretariat Working Party on Housing and Building Materials (2nd Meeting) to the Committee on Industry and Trade (7th Session). 1 April 1954, 48 p. E/CN.11/1 and T/102.
[Sc. Org. Ej.] The Inter-Secretariat Working Party on housing and building materials met for the second time in February 1954. Representatives from the Economic Commission for Asia and the Far East, from the UN, ILO, FAO, Unesco and WHO were present. The group made a wide survey of the problem of housing from the regional economic and social point of view: activities of the different organizations in this connexion, housing for workers in Asia, research, new materials, etc.

TECHNICAL ASSISTANCE

Sixth Report of the TAB. Interim edition. April 1954. Several volumes. E/2566, part I, 168 p.; E/2566, part II, 300 p.; E/2566, part III, 250 p.; E/2566, part IV, end, 150 p.
[Sc. Org. Pr. Dp. St. Ej.] Technical Assistance activities during 1953, with information on the 1954 and 1955 programmes. Complete and detailed handbook.

UN Programme of Technical Assistance. 20 April 1954, 42 p. E/2575.
[Sc. Ej. St. Org.] Summary of activities undertaken by the UN Technical Assistance Administration in 1953 in 79 countries. Regional and national projects and tables containing financial and statistical analyses for the year under review.

TRUSTEESHIP COUNCIL—NON-SELF-GOVERNING TERRITORIES

Summary of the Situation in the Trust Territories. A series of documents.
[Ej. Sc. St.] The Secretariat is publishing a series of working papers, which constitute the drafts of the chapters that will be devoted to each trust territory in the next report of the Trusteeship Council to the General Assembly. These reports recapitulate geographical and demographic data for each territory and contain information on recent developments and advances in the economic, social, political and educational fields.

In our previous review we mentioned reports in this series on the Cameroons and Togo. We have since received the following:

Conditions in the Trust Territory of Somaliland under Italian Administration. T/L.471 and supplement.

Conditions in the Trust Territory of Nauru. T/L.472 and supplement.

Conditions in the Trust Territory of Western Samoa. T/L.476.

Conditions in the Trust Territory of the Pacific Islands. T/L.478 and supplement.

Provision of Information to the Peoples of Trust Territories. 24 June 1954, 17 p. T/1121.
[Pr. Org. Dp.] Progress made in the spread of information about the UN amongst the population of the trust territories, by various media, such as press, radio, films and school curricula.

SECRETARIAT

CARTOGRAPHY

World Cartography. 30 June 1953, vol. II, 1952, 111 p., printed, $1.25. ST/SOA/Ser.L./2
[Sc.] 'World Cartography' is an annual publication which gives an account of activities in the various spheres affecting the establishment of maps of all kinds. Volume II includes a series of studies by specialists, consisting of accounts of activities and reports of conferences. Bibliography on photometry for the period 1946-52.

DEMOGRAPHY

Future Population Estimates by Sex and Age. Report I: The Population of Central America (including Mexico) 1950-1980 (Population Studies, no. 16). May 1954, 84 p. $ .70. ST/SOA/Series A/16.
[Sc. Ej. St.] The secretariat has started work on future population estimates for different regions. These studies are particularly useful for the drawing up of development programmes. The present report sums up what is already known about demographic trends in Central America and goes into the possibility of estimating and providing for the future populations of this region; relation with utilization of resources. Numerous statistics, maps.

MIGRATION STATISTICS

Sex and Age of International Migrants: Statistics for 1918-1947. 281 p., printed, $3. Bilingual: English-French.
[Sc. St. Dp. Ej.] Statistics for 74 countries covering the period 1918-47. This publication provides the facts necessary for a detailed analysis of the economic, demographic and social aspects of international migration for this period. For later years, the facts may be found in the *Demographic Yearbook of the United Nations.* Maps and graphs.

NATIONAL ACCOUNTING

Budget Management. 26 February 1954, 43 p., printed, $. 40. ST/TAA/Ser.C/14.
[Sc. Pr.] Report on a study meeting organized by TAB, the Economic Commission for Latin America and the UN Secretariat, in Mexico, from 3 to 11 September 1954, on modern methods of national accounting; the budget as an instrument of economic policy; delimitation of the field of the national budget; economic and functional classification of operations, etc. The meeting was attended by experts from Costa Rica, Cuba, the Dominican Republic, El Salvador, Guatemala, Haiti, Honduras, Mexico, Nicaragua, Panama, and the United States of America. Bibliography.

TOWN PLANNING

Urban Land Problems and Policies (Housing and Town and Country Planning. Bulletin 7). March 1954, 182 p., printed, $1.75. ST/SOA/Ser.C/7.
[Sc. Pr. Ej. Dp. St.] Collection of technical studies on the problems arising in regard to assignment, purchase, regrouping, etc., of land in regions that are being urbanized. Measures adopted by different countries. Bibliography.

ECONOMIC DEVELOPMENT OF EL SALVADOR

Proposals for the Further Economic Development of El Salvador, by W. J. Feuerlein. 1954, 160 p., printed. ST/TAA/K/El Salvador/5.
[Sc. Ej. St. Pr.] At the request of the Government of El Salvador, a general survey of the possibilities of economic development in the country was undertaken. This gave rise to the publication of a series of special studies (mentioned in our previous issue). The above-mentioned document is a general report in the survey: situation of the country, economic and social needs, finance, guiding principles and priorities, suggestions for an action programme. Annex: The national income of El Salvador in 1950 and a detailed description of an inquiry conducted by sampling into rents and family incomes of the urban population (sampling, methods, results).

EDUCATION IN THE NON-SELF-GOVERNING TERRITORIES

Special Study on Educational Conditions in Non-self-governing Territories. 1954, 133 p., printed, $1.50. ST/TRI/Ser.A/8/Add.1.
[Sc. St. Dp. Ej. Org.] Summary of recent work by the UN Assembly on education in the non-self-governing territories and series of monographs dealing with the following questions in these territories as a whole: illiteracy, compulsory education, Unesco activities concerning compulsory education, the education of girls, development of collectivities, equal educational opportunities, vocational training, higher education, the financing of education, participation of the people in the implementation of educational projects. Numerous bibliographical references.

DISABLED PERSONS

Services for the Physically Handicapped. 1954, 31 p., printed, $ .25.
[Pr.] Illustrated brochure on the problem of organizing the services and institutions of various types that a modern society can provide for disabled persons, in the widest sense of the term.

DELINQUENTS

The Indeterminate Sentence. 1954, 92 p., printed, $ .75. ST/SOA/SD/2.
[Sc. Pr. Ej. Dp. St]. The indeterminate sentence has the effect of adapting the length of stay in correctional and penal institutions to the individual needs of delinquents and the requirements of the protection of society. This study, which is confined to adult

delinquents, was carried out with the assistance of experts. It included the sending of a questionnaire to different countries. General and historical outline, comparative study of present situation, conclusions, bibliography.

TECHNICAL PROGRESS

Inland Water Transport in Europe and the United States of America. 1954, 141 p., printed, $1.50. ST/TAA/Ser.C/9.
[Pr.] Report by a mission of experts from Burma, India, Pakistan and Thailand, following a study on the spot organized by the UN as part of its endeavours to develop inland water transport in Asia and the Far East: the problem, the situation in Europe and the United States of America, particularly interesting procedures, their application in Asia and the Far East.

Report on the Inland Water Transport Demonstration Pilot Project in India, by J. J. Surie. April 1954, 34 p., printed. ST/TAA/K/India/4.
[Sc. Ej.] Technical, administrative, economico-social and financial plan for an extensive experiment designed to improve inland water transport in India (on the Ganges).

Problems of Indoor Climate in Israel, by George V. Parmelee. 1954, 36 p., printed. ST/TAA K/Israel/3.
[Pr.] Mr. Parmelee, an expert appointed by the World Meteorological Organization in agreement with the Government of Israel, studied the indoor climate in the houses in Israel and means of improving it (architecture, special researches, ventilation, etc.).

Railway Operating and Signalling Techniques in Europe, Japan and the United States of America. 1954, 109 p., printed, $1.25. ST/TAA/Ser.C/6.
[Pr.] Report by a group of very experienced experts from Burma, China, India, Indonesia, Pakistan, the Philippines, Thailand and Viet-Nam, who were responsible for collecting first-hand information on railway technique in various advanced countries, in order to be able to suggest ways of improving railway technique, in various respects, in Asia and the Far East. Bibliography.

II. SPECIALIZED AGENCIES

INTERNATIONAL LABOUR ORGANISATION[1]

ACTIVITIES OF THE ILO

Eighth Report of the ILO to the United Nations. 332 p., printed, $2.
[Org. Ej.] Detailed handbook of recent activities of the ILO, present stage of the projects and their future; important ILO events, current work and permanent tasks, regional activities and concrete action, collaboration with the UN and the specialized agencies. Precise references. The publication relates to 1953 and the first months of 1954, with some information on present and future programmes.

LABOUR LEGISLATION

Le code international du travail (International Labour Code). 1951, vol. I: Code, 1954, 1,314 p., printed; vol. II: Annexes, 1954, 1,309 p., printed. Together $10. The English edition, published in 1952, has already been mentioned).
[Sc. Pr. Org.] Orderly presentation, with commentaries, of all the provisions contained

[1] As a general rule, ILO publications are issued in English, French and Spanish.

in each of the conventions and recommendations adopted by the International Labour Conference, and of other norms of labour legislation worked out by the conference, by technical commissions and meetings, regional conferences, commissions on industrial problems, etc. Covers the period 1919-51. Detailed notes on the application and the meaning of all these elements of international law on labour.

Summary of Reports on Ratified Conventions. International Labour Conference, thirty seventh session, 1954. 1954, 240 p., printed, $2.50. Report III(1).
[Sc. Ej. Dp.] In accordance with its constitution, the ILO receives reports from governments on the measures they are taking to implement the conventions to which they have acceded. These reports are summarized and published, so that they may be discussed by the conference and studied by employers' and workers' organizations throughout the world. The above report covers the period from 1 July 1952 to 30 June 1953 and deals with 72 conventions.

PRODUCTIVITY

Higher Productivity in Manufacturing Industries. 1954, 195 p., printed, $1.25.
[Sc. Pr. Ej.] Conditions influencing productivity and consequences of an increase in productivity: attitudes, economic factors, institutions, equipment and machinery, organization and direction of production, professional training, employment and working conditions. Measures likely to promote an increase in productivity. Conclusions of a group of experts.

HUMAN RELATIONS

Human Relations in the Iron and Steel Industry. 1954, 138 p.
[Sc. Ej.] Question placed on the agenda of the fifth session of the Iron and Steel Committee (1954). The above report was prepared as a basis for discussion. Points dealt with: present position with regard to this question, role played by various factors, responsibilities of owners and management, the function of communications. Bibliography.

Practical Methods of Labour-management Co-operation in Metal-working Plants. 1954, 148 p.
[Sc. Pr.] The Metal Trades Committee has been studying the question of human relations in its particular field. It now considers that the time has come to proceed to a new stage: the study of practical means of improving these relations, especially the relations between workers in connexion with employers and plants. The above report was prepared with a view to this study. It defines the problem, describes eight typical successful experiments made in plants in different countries (United Kingdom, United States of America, Sweden, France, Canada, Switzerland), and draws general conclusions.

PAYMENT BY RESULTS

Systems of Payment by Results in the Construction Industry. 1954, 20 p., printed, $ .15.
[Pr.] Conclusions of a meeting of experts on the aims, methods, effects and relative advantages and disadvantages of the systems in question, on the basis of concrete examples.

SOCIAL SERVICES

Welfare Facilities for Workers. International Labour Conference, thirty-eighth session, 1955. 1954, 96 p., printed, $ .75. Report VIII(1).
[Sc. Pr. Dp. Org.] In 1955 the conference will study the question of welfare facilities, such as meals in the works or near, rest and amusements in the works or near, and transport between home and place of work. This report gives an idea of what has been

accomplished to date by the ILO in these various fields and analyses the legislation and practice of the different countries in the same fields.

LABOUR PROBLEMS IN THE IRON AND STEEL INDUSTRY

Recent Events and Developments in the Iron and Steel Industry. 1954, 130 p.
[Pr. Ac. Ej. Dp. St.] General report for the fifth session of the Iron and Steel Committee (1954): analysis of the main provisions of the international labour code concerning this industry, development of production and employment during the last few years, technical assistance contributed by the ILO in regard to professional training in the iron and steel industry, other international activities relating to this industry, professional relations and labour conditions; special chapters on the 'denationalization' of the iron and steel industry in the United Kingdom, and on labour problems in the European Coal and Steel Community.

Supplementary Pensions Schemes in the Iron and Steel Industry and their Relation with General Pension Schemes. 1954, 61 p.
[Pr.] Schemes designed to supplement those laid down by law, either through the imposition by the state of a special scheme for certain categories of wage-earners, or by supplementary schemes based on collective agreements or on private initiative. Their field of application in the iron and steel industry of the various countries, payments, adjustment to general schemes.

AGRICULTURE

Vocational Training in Agriculture. International Labour Conference, thirty-eighth session, 1955. 1954, 78 p., printed, $ .50. Report VII (1).
[Sc. Pr. Dp. Org.] Preliminary report: the ILO and vocational training in agriculture, aims of vocational training in regard to the general raising of the standard of living and the welfare of rural workers, methods of training, the role of governments, schools and curricula, legislation and practice in the different countries.

ASIA

The Asian Regional Conference: Tokyo 1953. 1954, 20 p., printed, $ .15.
[Org.] The ILO convenes regional meetings for the study of problems peculiar to certain groups of countries. The Tokyo Conference—the third Asian Conference of the ILO—made a special study of wages, housing and the protection of young workers. General survey of the work of the conference.

UNITED NATIONS FOOD AND AGRICULTURE ORGANIZATION (FAO)

STATISTICS

Yearbook of Food Agricultural Statistics: Production 1953. Vol. VII, part I, 334 p., printed, $3.50. Trilingual: English-French-Spanish.
[Sc. St.] Information available on 1 February 1954 concerning soil, cultivation, crops, livestock and its products, food resources, means of production and prices. Series for the prewar period. Part II of the Yearbook, which appeared before Part I, was mentioned in our previous issue.

NUTRITION

Report of the Third Conference on Nutrition Problems in Latin America. 1954, 60 p., printed, $ .50.
[Sc. Pr. Ej. Dp.] This conference was held at Caracas in October 1953, under the

auspices of the FAO and WHO. It reviewed the different aspects of the general progress towards a balanced diet in the region and examined in particular protein deficiences in mothers and children, and endemic goitre.

MECHANIZATION

Considerations and Procedures for the Successful Introduction of Farm Mechanization. 1954, 36 p., printed, $ .50.
[Pr. Ej.] The introduction of farm mechanization without previous preparation can cause serious difficulties in some countries, but the modernization of agricultural methods is nevertheless a necessity. The aim of this brochure is to show with the help of examples that carefully laid plans, efficient services and qualified staff are indispensable to the success of mechanization. Study of needs and possibilities, methods, vocational training, cost of mechanization, etc.

COMMUNAL PROPERTY

Communal Land Tenure, by Sir G. Clauson. 1954, 55 p., printed, $ .50.
[Sc. Ej.] One of a series of brochures on property systems viewed from the standpoint of agrarian reform. Does not deal with co-operative or collective systems in the modern sense (these will be dealt with in special brochures), but with communal land tenure of the type encountered in early civilizations—and still existing, for example, in Switzerland. Different systems of primary communal land tenure (in communities where individual property is unknown) and of secondary communal land tenure (communities where individual property is the exception, landed property belonging mainly to the larger family or clan); future of these systems.

FORESTS

Eucalyptus for Planting. 1954, 395 p., printed, $3.50.
[Pr. St. Dp.] In many cases eucalyptus provides an effective solution to the problem of the growing disequilibrium between the forest area in certain countries with a subtropical or Mediterranean climate and the needs of the population and economy of the country. Complete survey of the question for the use of specialists.

WATER

Water Laws in Moslem countries. 1954, 202 p., printed, $2.
[Sc. Pr.] Compilation of laws and customs concerning the use of water in Moslem countries, with commentary. Designed chiefly for those responsible for agricultural programmes or economic and social development plans that might be affected by these standards and traditions.

WORLD HEALTH ORGANIZATION (WHO)

STATISTICS

First International Conference of National Committees on Vital and Health Statistics. (*Technical Report Series*, no. 85.) Report 1954, 30 p., printed, $ .25.
[Sc. Pr.] Some 30 countries and various international organizations took part in this conference in London. The aim of the committees is to help fix requirements as regards demographic and health statistics and to encourage improvement in this direction. Summary of the problems aiming in this connexion. Recommendations.

MONOGRAPHS

Laboratory Techniques in Rabies (*Monograph* no. 23). 1954, 150 p., printed, $3.
[Sc. Pr.] Handbook dealing mainly with problems arising in the Middle East, South-East Asia and the Pacific: diagnostic techniques, the production of vaccines and serums, tests for the effects of vaccines and serums, etc.

Donovanosis, by R. V. Rajam and P. N. Rangiah (*Monograph* no. 24). 1954, 72 p., printed, $1.50.
[Sc. Pr. St.] Donovanosis is a contagious, slowly developing venereal disease, described by Donovan in Madras, in about 1905. It is particularly prevalent in China, India, Australia, Africa and certain parts of America. Survey of modern knowledge of the causes, effects and treatment of this disease, whose social implications are manifold.

DISEASES TRANSMISSIBLE FROM ANIMALS TO HUMAN BEINGS

Advances in the Control of Zoonoses (*Monograph* no. 19). Published jointly by FAO and WHO. 1954, 275 p., printed, $3.
[Sc. Pr.] Includes the main contributions to the WHO/FAO symposium on zoonoses held in Vienna in 1952. (Zoonoses are animal diseases transmissible to man, such as certain forms of tuberculosis.) Summary of the discussions. Zoonoses in man can, to a large extent, be prevented by attacking them in animals. This raises important problems connected with public health, professional training, etc.

The Zoonoses—i.e. diseases which can be transmitted from Animals to Man. Epidemiological and vital statistics report. 1954, vol. VII, no. 7, 27 p., printed, $ .50. Bilingual: English-French.
[St. Dp.] Statistical data available on deaths due to some of the chief zoonoses in the different countries since 1951: brucellosis, tularemia, tetanus, anthrax, rabies, fever.

HEALTH MEASURES IN RURAL DISTRICTS

Methodology of Planning an Integrated Health Programme for Rural Areas. (*Technical Report Series*, no. 83.) Second report of the expert committee on public health administration. 1954, 46 p., printed, $ .25.
[Pr.] At this meeting, the special task of the experts was to select from the possible methods those that might be applied to the different forms of health administration and to economic and social organization: fundamental activities, organization, staff, financing of the local health service in rural areas within the framework of a general programme, as the case might be.

BACKWARD CHILDREN

The Mentally Subnormal Child (*Technical Report Series*, no. 75.) Report of a joint expert committee convened by WHO, with the participation of the United Nations, ILO, and Unesco. 1954, 46 p., printed, $ .25.
[Sc. Pr. St.] The problem discussed in the light of modern knowledge. There are many degrees of backwardness and it is possible to distinguish between superficial forms (three out of four children are only retarded and can be adjusted) and more deeply lying forms of backwardness. Definition and classification, frequency, inquiries and researches, prevention, services for mentally subnormal children, training of staff, education of parents and public, juridical problems.

UNITED NATIONS EDUCATIONAL, SCIENTIFIC AND CULTURAL ORGANIZATION (UNESCO)

INQUIRY INTO THE UNIVERSITY TEACHNG OF THE DIFFERENT SOCIAL SCIENCES

[Sc. Pr. St. Dp. Ej.] Following an international inquiry into the teaching of the different social sciences at university level, Unesco has published five reports giving an idea of the present situation of each discipline, its importance in the programmes, its theoretical and practical links with related disciplines, the recruiting and training of teaching staff, the connexion between teaching and research in the field under review, etc. The reports contain personal observations and criticisms by the various authors, and suggestions for the solution of the problems revealed by the inquiry. The various elements of the inquiry were discussed at meetings of experts specially convened for the purpose. The authors of the final reports took into consideration the remarks made at the meetings. The work was done on the responsibility of the international associations of the social sciences.

The rapporteurs made special use of reports coming from a certain number of countries, constituting a representative sample of the different regions of the world.

The University Teaching of Social Sciences: Sociology, Social Psychology and Cultural Anthropology, by Pierre de Bie, Claude Lévi-Strauss, Joseph Nuttin and Eugène Jacobson. In the press.

Broad, detailed survey of the whole field by P. de Bie; situation, trends, problems, particularly in regard to cultural anthropology (C. Lévi-Strauss) and social psychology (J. Nuttin and E. Jacobson). Special attention is paid to the following countries: Australia, Egypt, France, Great Britain, India, Mexico, Poland, Sweden, the United States of America. Belgium, Germany, Italy, Norway and Switzerland are studied more briefly.

The University Teaching of Social Sciences: International Relations, by C. A. W. Manning. 1954, 100 p., printed, $ .75.

International relations or the study of relations between the various national communities making up the international society now in process of formation; the conditions under which this subject is taught at present, the recruitment and training of teachers; international relations as a field of interdisciplinary research and as an independent subject, future prospects, suggestions and conclusions. Countries to which special attention is given are: Egypt, France, India, Mexico, Sweden, United Kingdom, United States of America, Yugoslavia.

The University Teaching of Social Sciences: Economics. 1954, 300 p., printed, $2.

General survey by C. W. Guillebaud and national monographs: Belgium (R. Clemens), Egypt (Wahib Messiba), France (E. James), Germany (F. Lütge and E. Preiser), India (C. W. Vakil), Italy (C. Arena), Mexico (A. Kozlik), Sweden (T. Palander), United Kingdom (C. W. Guillebaud), United States of America (H. Taylor), Yugoslavia (R. Uvalic). As a rule, each study gives statistics and other information regarding the form and extent of economics teaching, an analysis of its aims, methods and programmes, the position of teachers, research, conclusions and suggestions. The work contains a special chapter on the teaching of econometry in the same countries (G. Tintner).

The University Teaching of Social Sciences: Political Science, by William A. Robson.

The author relies mainly on reports from the following countries: Canada, Egypt, France, Germany, Great Britain, India, Mexico, Poland, Sweden and the United States of America. His study includes a free discussion of questions which, to judge from the information furnished by the inquiry, require examination. It also provides, in appendices, summaries of the facts contained in the various reports. The main themes of the work are: definition and subject matter of political science, situation in

the different countries, connexions with related subjects, teaching methods, recruitment and training of teachers, co-ordination of research, problems and needs.

The University Teaching of Social Sciences: Law, by Charles Eisenmann.
Analysis of the basic problems of adapting the aims of law teaching to the needs of our time and a survey of the solutions adopted in the following countries: Belgium, Egypt, France, Germany, Great Britain, India, Libya, Mexico, Sweden, Yugoslavia and the United States of America. In the annex are the conclusions of a special symposium held at Cambridge in 1952 and a note on the proposed reform of law teaching in France.

EDUCATION

Compulsory Education in South Asia and the Pacific. Account of the Bombay Conference, 1952. 1954, 156 p., printed, $1.
[Sc. Pr. Dp. Ej. St. Org.] The work of the conference is not merely summed up but placed, by means of a rich documentation, in the context of the cultural and educational circumstances of the region. The conference studied questions of administration, finance, legislation and technique (curricula, teacher training, arising from the introduction of free compulsory schooling for all children of school age in this part of the world. Events leading up to the conference, the problem to be solved, the situation as it is (general survey and special note on each country), discussions of the conference on the various questions and recommendations. Fifteen of the 18 states located in the region, or administering territories there, took part in the conference, which also enjoyed the collaboration of observers and experts. Bibliography.

Bilateral Consultations for the Improvement of History Textbooks. 1953, 45 p., printed, $ .40.
[Pr. Sc. Org. Dp. Ej.] Description of the work accomplished since 1945 by bilateral committees or other bodies whose task it was to make a critical study of textbooks and recommend improvements with a view to promoting international understanding. Canada-United States of America; consultations between Germany and a number of other countries; France-America; United Kingdom-United States of America; the Scandinavian countries, etc.

Modern Languages in the Schools. 1953, 86 p., $ .50.
[Dp.] Series of graphs showing the place of modern languages in the curricula of the different countries.

COMMUNITY DEVELOPMENT, FUNDAMENTAL EDUCATION, ADULT EDUCATION

Education for Community Development. A selected bibliography by Unesco and the UN. 1954, 49 p., printed, $ .40.
[Sc. Pr.] The community development idea and its connexion with fundamental education and economic development are analysed in a preliminary note. General community development is seen as the working out and expansion of vast programmes of social progress, based on popular initiative and effort, helped from without, but remaining in close touch with the needs of the local community: the raising of the standard of living, social services, public health, education, agriculture, handicrafts, housing, local government, co-operatives, etc.

The bibliography contains 116 brief analyses of publications (books, articles, reports, etc.) selected from general works on the theory and practice of community development or on special projects, a list of 84 specialized periodicals and a directory of useful addresses. Index.

Fundamental and Adult Education: Associated Projects and Agencies. 15 March 1954, 3 p., Unesco/ED/81(Rev.); June 1954, 5 p., Unesco/ED/81(Rev.)Annex.
[Pr. Org.] The first of these documents describes the aims of the system, which through

exchanges of information and technical aid provides a link between Unesco and popular education centres, movements of social, economic, political and cultural progress in certain communities, fundamental education missions, etc. The second document gives a list of current associated undertakings.

TECHNICAL ASSISTANCE AND SOCIAL CHANGE

Social Aspects of Technical Assistance in Operation, by E. Opler. 1954, 79 p., printed, $ .75.

[Sc. Pr.] It is practically impossible to provide a country with technical assistance without affecting some essential aspect of its economic, political or social structure, by introducing new ways of life, institutions, problems and possibilities. How can the sociological consequences of technical assistance be harnessed to the particular needs and aspirations of the communities concerned?

A conference of experts was held under the auspices of the UN, TAB and Unesco, in New York, March-April 1953. Professor Opler explains the subject of the conference and sums up its discussions and conclusions: the nature, aims and implementation of technical assistance programmes, their dynamic relations with social structures, the resistance to changes in technique, experts and their role, the appreciation of technical results and sociological consequences of technical assistance. Bibliography.

EDUCATION OF WOMEN

The Education of Women for Citizenship; Some Practical Suggestions, by Marjorie Tait. 1954, 106 p., $1.

[Sc. Pr.] Unesco has published three separate, parallel, studies on this theme: one in French, by Miss H. Sourgen (*L'éducation civique des femmes: quelques suggestions pratiques*), one in Spanish, by Ana Figueroa (*La mujer ciudadana: sugestiones destinadas a la educación de las mujeres*); and the above in English, by Dr. Marjorie Tait. Each of these studies reflects both a personal attitude to the problems raised by the need to provide women with a civic education appropriate to the new rights and responsibilities they have acquired in political, economic and social life during the last 10 years, and the way these problems appear in the light of the particular culture to which the author belongs. The way in which the question arises, the role of the school, civic education and the family and professional life of women, local aspects of the problem, national and international aspects. Bibliography.

ARTISTS AND MODERN SOCIETY

The Artist in Modern Society. 1954, 132 p. $1.

[Sc.] Survey of the International Conference of Artists held in Venice in 1952, which discussed various aspects of the problems facing the creators of literary and artistic works in modern society: how can they be defended and helped without endangering their independence? Aims of the discussion, final reports, resolutions. Most of the work is taken up by statements in which the artists explain how they view the integration of the artist into society: Alessandro Blasetti, Marc Connelly, Lucio Costa, Arthur Honegger, Taha Russein, N. C. Mehta, Henry Moore, Ildebrando Pizzetti, Georges Rouault, Giuseppe Ungaretti, Jacques Villon, Thornton Wilder. The work constitutes a kind of panorama of the aspirations and fears, the impulses and rejections of the artist in the face of our present civilization.

THE WORLD PAPER PROBLEM 1928-1965

Newsprint Trends, 1928-1951. 1954, 63 p. $ .50.

[Sc. Dp. St. Ej.] Three recent Unesco brochures make available to the public detailed information on the fundamental trends of paper distribution throughout the world, with its manifold social and cultural repercussions. Two of these studies deal with the

developments of the last 30 years, the third is an attempt to estimate what will probably happen in the next 10 years. The above publication is the first of the three. It contains, in the form of statistical tables and graphs, all the information gathered by the UN and other bodies, as well as particulars obtained by means of a special questionnaire sent to governments, concerning production, exchanges and consumption of newsprint, by country, continent and per head of the population.

Paper for Printing (other than Newsprint): 1929-1951 Trends. 1954, 42 p., printed, $ .40.
[Sc. St. Dp. Ej.] A study prepared along the same lines as the preceding one, but dealing with notepaper and paper for printing, with the exception of newsprint. Comments and graphs.

Paper for Printing Today and Tomorrow, by the Intelligence Unit of *The Economist*. 1954 London, 139 p., printed, $ .25.
[Sc. Dp. St. Ej.] This publication analyses the probable trends during the next 10 years, making use of the information contained in the two publications mentioned above. The estimates presented take into account demographic and economic trends, the gradual disappearance of illiteracy, and educational progress, according to countries and regions. General assessment and brief monographs for each country and territory contained in a series of chapters devoted to the different regions of the world: Africa, North America, South America, Asia, Europe, Union of Soviet Socialist Republics.

THE PRESS

The Daily Press: Survey of the World Situation in 1952. 1954, 45 p., printed, $ .40.
[Sc. Ej. Dp. St.] Statistical information on the number of daily papers (total, evening papers, morning papers), their circulation (global and per head of the population), number of pages, price, language in which they are printed, for all countries and territories of the world, in 1952. The information is set out in different tables: all the particulars for each country, continent, and for the whole world, lists of countries and territories where no daily paper appears, countries having more than 100 daily papers, countries where the circulation of daily papers exceeds three million copies, average circulation of the daily press, copies per 1,000 inhabitants (percentage for the whole population, and percentage for every thousand inhabitants over the age of 15 and able to read), number and circulation of daily papers according to the language in which they are printed, etc. Comments. Illustrations. Graphs.

Education for Journalism, 1953. 1954, 43 p., printed, $ .40.
[Sc. Pr. Dp. St. Ej.] The training of journalists—for press, radio and films—raises complex problems which are solved in very different ways according to the country and the particular branch of specialization. Well documented, the above brochure reviews the various aspects of the world situation: brief historical background, different kinds of curricula, institution for the training of journalists, their methods and rules, the number of students. Brief mention of courses arranged in over 40 countries with, in an annex, a detailed description of typical systems.

FILMOLOGY AND THE SOCIAL SCIENCES

Bibliography on Filmology as related to the Social Sciences, by Jan C. Bouman. 1954, 42 p., printed, $ .40.
[Sc.] Some 700 references to books, articles in reviews, etc., relating to the study of the film, its history, its social and cultural role, its effects, factors determining the content of films from the varied standpoints of psychology, sociology, psychiatry, physiology, anthropology and philosophy. Translations of all the titles in French and in English.

SOCIAL SCIENCES IN INDIA

Social Science Bibliography: India, 1952. New Delhi, 1954, 190 p.
[Sc.] Published by Unesco's Scientific Co-operation Office at New Delhi, as a contribution to the efforts of the International Committee for co-ordination of social science documentation.

Contains a classified list of 104 specialized periodicals appearing in English in India and about 1,500 references relating to books, reports and articles that have come out in English in India during 1952, dealing with psycho-sociology, anthropology, politics and economics. A similar bibliography is to be published every year.

CATALOGUE

Unesco Catalogue. July 1954. 92 p., printed.
[Pr. Org.] List of all the English publications brought out by Unesco since its inception, and also publications of the old International Institute for Intellectual Co-operation that are not out of print, with a brief analysis of the contents.

There are separate catalogues for Unesco publications in French, Spanish and Arabic.

EXPLANATION OF ABREVIATIONS USED IN PART II

Dp. = Presents facts country by country (or region by region).
Ej. = Supplies essential information to educators and journalists interested in social questions.
Org. = Is very useful for knowledge of the current activities of the international organization concerned.
Pr. = Supplies useful factual information for certain groups of people (educators, government officials, members of international organizations and economic and social institutions, etc.) whose activities are connected with the subject-matter of the document.
St. = Contains statistics.
Sc. = Deserves the attention of scientific workers in the field concerned.

The importance of these conventional signs is, of course, purely relative, and we do not wish their use to be taken as implying a system of classification. We use them merely in order to give as brief an abstract as is consistent with indicating, in the easiest way possible, that part of the contents of the publications and documents under review which relates to some particular branch of social science.

INTERNATIONAL REVIEW OF PERIODICALS

UNITED NATIONS ORGANIZATION

GENERAL

LUNS (J. M.). 'Town Meeting of the World', *Pakistan Horizon* 6(3), September 1953, p. 93-100.
Eight years after the United Nations Organization was created, the hopes expressed at San Francisco have, in many people's minds, given way to a certain scepticism. Yet the idea of national sovereignty has already been considerably attenuated, as is shown by the attempts to unify Europe, and, on a world scale, by the powers which the Security Council exercises. Moreover the United Nations, which is more 'representative' than

the League of Nations was, has provided a forum for the public debating of most of the great international political issues; and practical work of the greatest importance has been accomplished in the economic, social, technical and humanitarian spheres. Lack of achievement by the United Nations in the political field is partly explained by the time wasted over secondary matters which would appear to be the province of regional organizations; results of the formation of blocs in the United Nations; and the inadequacy of Western European representation. The solution of some of the present difficulties may depend upon revision of the Charter in 1955.

LOEWENSTEIN (K.). 'Sovereignty and international co-operation', *The American Journal of International Law* 48(2), April 1954, p. 222-44.
International co-operation, though still at the experimental stage, is increasingly stripping the legal notion of national sovereignty of its meaning. The conflicts between the two is well illustrated in the economic sphere by the European Coal and Steel Community, and in the military sphere by the North Atlantic Treaty Organization. Another striking aspect of this development is the fact that it favours the formation of two blocs, under the hegemony of the Union of Soviet Socialist Republics and the United States of America respectively. We see, therefore, that the United Nations does not fill the role which, in normal circumstances, it should fill in this field; and this anomaly combined with the fact that international law is ill adapted to the new relations between states, contributes to the 'growing pains' to which experiments in co-operation are at present subject.

AHMED (M.). 'Admission of New Members to the United Nations', *Pakistan Horizon* 6(4), December 1953, p. 161-71.
The problem of the admission of new members is nearly as old as the United Nations Organization itself. The Charter requires that there shall be a two-thirds majority of the General Assembly in favour of a candidature before it is accepted. A state applying for membership must first give proof of its peaceful intentions and its ability to undertake the obligations imposed by the Charter. But before the Assembly takes any decision the candidature must be approved by the Security Council, where, as in many other fields, the veto has exercised a paralysing effect. Only nine out of 30 candidatures have been referred to the Assembly and accepted. The Union of Soviet Socialist Republics, which at first opposed the admission of all the candidates en bloc, is now in favour of it because the number of candidates belonging to the Soviet bloc has increased. The United States, supporting an opinion of the International Court of Justice which condemned the Soviet attitude of not admitting certain candidates unless its own nominees were accepted, has gone back on the position it originally adopted in favour of bloc admissions, and now demands that each candidature be considered separately. In these circumstances the question of admitting new members seems to be just another aspect of the cold war, and sincere co-operation between the two great powers in question becomes more than ever a *sine qua non* for the success of the United Nations.

GREEN (L. C.). 'The Security Council in Retreat', *The Year Book of International Affairs* 8, 1954, p. 95-117.
Since the creation of the United Nations, the evolution of the Security Council's role has reflected the change in the balance of political power throughout the world. After a brief period of unanimity and effective co-operation, differences of opinion among the great powers have almost completely paralysed this vital organ of the United Nations, and the attempts made to expand the powers and authority of the General Assembly have proved but a derisory remedy for this state of things.

ROSSIGNOL (A.). 'Des tentatives effectuées en vue de mettre un nouveau mécanisme de sécurité collective à la disposition de l'Assemblée Générale des Nations Unies et de leur inconstitutionnalité', *Revue générale de droit international public* 25(1), January-March 1954, p. 94-129.

If we examine the fundamental text of the resolution 'Uniting for Peace', adopted on 3 November 1950, or the complementary resolutions adopted on 12 January 1952 and 17 March 1953, we are struck by the contrast between the vagueness of their provisions and the high intention of their authors, as revealed for instance by the reports of the Collective Measures Committee. Sincere co-operation between Member States would have permitted the evolving—for the first time in history—of a system of collective security founded on the contribution of all states, in proportion to their economic and military resources. Legal discussions, even more than states' traditional attachment to their sovereignty, have weakened the strength of the new machinery. Moreover, as is shown by a careful analysis of the texts in question, the adoption of this machinery in fact represents a considerable alteration in the distribution of powers effected at San Francisco between the General Assembly and the Security Council; it violates the Charter both in letter and in spirit. There is no doubt that it would have been better to have followed the procedure prescribed in the Charter for its revision, as this would have left the door open to an agreement between the Great Five, whose unanimity is essential to world security.

STRANGE (S.). 'The Economic Work of the United Nations', *The Year Book of International Affairs* 8, 1954, p. 118-40.

It is difficult to form an objective judgment of the economic work of the United Nations, owing to the impossibility of making any valid comparisons. Before the end of hostilities, the United States and Great Britain desired that the future international organization should ensure economic co-operation between states, as well as their political security. Consequently, the aims assigned to the Economic and Social Council were ambitious and the number of organs, specialized institutions and commissions established considerable; whereas the real powers of the United Nations in the economic field remained very limited. The three main fields of its activity have been reconstruction, the removal of trade restrictions, and economic development. Concrete results have been achieved in each of these fields; generally speaking, however, the states have placed their responsibility for the economic development and stability of their own territories higher than the world responsibility incumbent on them as members of the United Nations. The economic indivisibility of the world is far from being understood or recognized by most nations.

WINKLER (H. R.). 'The United States and the United Nations', *The Year Book of International Affairs* 9, 1954, p. 46-68.

As a member of the United Nations, the United States is making increasingly systematic use of this organization as an instrument for strengthening the cohesion and security of the free world. The breakdown of co-operation between the great powers after numerous crises—of which the Korean war had the most serious consequences—created in the United States not only a feeling of disillusionment about the effectiveness of the United Nations, but also a certain indifference towards its ideals. Public opinion polls showed that isolationist tendencies had made considerable progress. The United States, after setting itself up as the champion of anti-colonialism, has made concessions to the colonial powers in order to win them as military allies. Likewise, it has gradually abandoned its plans of economic assistance, in order to promote mutual defence programmes. However, a speech like that made by President Eisenhower in December 1953 on the utilization of atomic energy for peaceful purposes shows that America has not lost all hope of re-establishing a spirit of conciliation in the United Nations.

POPPER (D. H.). 'American Security and the United Nations', *World Affairs Interpreter* 25(1), spring 1954, p. 9-32.

The United Nations has made a far from negligible contribution to the security of the United States. The Korean war is undoubtedly the most striking example that can be quoted in support of this contention; but quite apart from this exceptional recourse to force, the United Nations has facilitated the solution of serious political conflicts,

all of which involved a risk of world war. Further, the United Nations has been a forum of inestimable value to the United States. Thus, America has been able to expound its point of view openly and submit it to its allies, as well as to its adversaries, for their criticism. Likewise, as regards the economic and social activities of the United Nations and its specialized agencies, the contribution of the United States has genuinely served the latter's national interests. Moreover, could there be better proof of the benefit which a great power derives from its work in international organizations than the recent reversal of attitude on the part of the communist states which, after years of boycotting, now seek entrance to the ILO or Unesco?

FRANKEL (J.). 'The Soviet Union and the United Nations', *The Year Book of International Affairs* 8, 1954, p. 69-94.

Although, at the start, the Soviet Union showed a marked preference for an international organization based on the delimitation of spheres of influence, this did not prevent it from co-operating loyally with the organization until 1946. The complaint lodged by Iran and its discussion by the Security Council provided the first proof of a serious divergence of opinion between the great powers, and showed the Russian rulers the dangers attaching to their 'minority representation' in an organization with a competence as extensive as that of the United Nations. Since that date, tensions have increased and there is no doubt that the United Nations has become an effective instrument of co-operation between the non-communist countries, but has failed in its essential purpose, namely to ensure international conciliation and the lessening of conflict. However, while the Union of Soviet Socialist Republics has adopted a purely negative attitude since the Korean war, it has not disavowed the principles on which the organization is based, but simply denounced the 'perversion' of the original institution. It seems that we can expect the Union of Soviet Socialist Republics to co-operate more sincerely with the United Nations organs as soon as the other great powers show greater goodwill.

DE GROOT (E.). 'Great Britain and the United Nations', *The Year Book of International Affairs* 8, 1954, p. 21-45.

The commercial vocation of Great Britain explains its attachment to the maintenance of peace. The policy followed by this country in the United Nations up to the Berlin crisis was based on a desire to maintain, at all costs, the unanimity of the five great powers, without which the organization would have been paralysed. When the aggravation of the tension between the East and the West led the United Kingdom Government to doubt the efficacy of such a policy, there was a complete change in the foreign policy of Great Britain, which, by adhering to the North Atlantic Treaty, i.e. by resolutely joining one of the hostile camps, broke with a time-honoured tradition. This attitude was confirmed during the Korean war. However, Great Britain preserves a realist view of world events and a sincere desire to safeguard the principle of universality on which the United Nations continues to be based. While this country has succeeded, so far, in reconciling the Atlantic alliance and its fidelity to the international organization with its national interests, it has done so at the cost of sometimes serious tensions between itself and the United States; the recognition of the People's Republic of China is an example of this pragmatism, on which the chances of world peace largely depend.

CHAMBERLIN (W.) and CLARK (H.). 'Materials for Undergraduate Study of the United Nations', *The American Political Science Review* 48(1), March 1954, p. 204-11.

The main materials for a bibliography on the United Nations intended for undergraduates are provided by that organization's official publications. Next, there are the periodicals, which also constitute a good source of information. On the other hand, few books have been devoted to this study and, while the role of the United Nations in the maintenance of peace and security, and that of some of its main organs, are relatively well described, works on the Secretariat, the Economic and Social Council,

the Trusteeship Council and United Nations action in the economic, social, administrative and financial fields are still almost entirely lacking.

International Organization

BELOFF (M.). 'Problems of International Government', *The Year Book of World Affairs* 8, 1954, p. 1-20.

The fundamental divergence between the economic and social evolution of the world and the political evolution of states undoubtedly constitutes the main cause of the difficulties at present confronting international organization. This conflict, whose symptoms are to be found in the Union of Soviet Socialist Republics, in extremely acute so far as the Western powers, and more particularly the United States of America, are concerned. Whereas technical progress robs the classical notion of independence of all its meaning and makes close co-operation between the various nations indispensable, the world continues to be based, politically, on the principle of national sovereignty. On the other hand, the democratic ideal is scarcely compatible with an extension of the powers of international organizations on which governments, but not peoples, are represented. These tensions call for a choice between three possible solutions: a return to the former ideas of autonomy and sovereignty; the establishment of a supra-national state, i.e. a world political community; or the development of an international technocracy, the precursors of which are to be found in the North Atlantic Treaty Organization and the European Coal and Steel Community. It is impossible to foresee which of these theoretical solutions will prevail. At the most, we can anticipate that technocratic conceptions will encounter violent opposition, of which the Bricker Amendment is a significant example.

JOHNSON (H. C.) and NIEMEYER (G.). 'Collective Security: The Validity of an Ideal', *International Organization* 8(1), February 1954, p. 19-35.

The expression 'collective security' designates very different things, for it has been applied in turn to the policy of the League of Nations and to that of regional defence organizations, such as the North Atlantic Treaty Organization. Based on a certain number of universal principles, the idea of collective security can have a concrete meaning only if it is placed in the service of convergent national interests. Consequently, the definition of these general concepts is of less importance than a realistic study of the distribution and balance of the world's political forces.

ROPER (E.). 'American Attitudes on World Organization', *The Public Opinion Quarterly* 17(4), winter 1953-54, p. 405-42.

A public opinion poll covering 3,500 persons in the United States makes it possible to give a general outline of the reactions and wishes of the American public with regard to the efforts to promote international organization. While the answers obtained reveal a fairly general pessimism as to the chances of maintaining peace, it must be noted that the overwhelming majority of Americans are in favour of a certain degree of 'internationalism'. For most of them the United Nations represents a guarantee for peace and security—a guarantee which, though certainly improvable, cannot easily be replaced. Thus, it may be inferred from this inquiry that isolationist ideas have for many years received undue representation in the press and in Congress, and that the hope of a possible agreement with the Union of Soviet Socialist Republics—which remains the basis of Eisenhower's policy, as it was of Truman's—is fairly widespread in the United States. A further interesting and unexpected result of this poll is that the answers do not seem to have been influenced by the social or geographical environment of the persons interrogated.

QUESTIONS OF INTERNATIONAL LAW

IVANOV (F.) and VOLODIN (S.). 'Piataja sessia Komissii Meždunarodnoo Prava OON' (The fifth session of the United Nations International Law Commission), *Sovetskoe Gosudarstvo i Pravo* (Moscow) 7, 1953, p. 88-100.

The fifth session of the United Nations International Law Commission was held in Geneva from 1 June to 14 August 1953. Although it consists of representatives of the world's main legal system, this commission in the author's view in fact complies with the wishes of the states under American influence. The majority of the commission's members subscribe to the theory of 'world government', which is the negation of international law. This majority, under the pretext of the 'progressive evolution of international law', is concerned to abolish the latter's fundamental principles. Only the Soviet and Czechoslovak representatives defend the established rules of international law, based on respect for the sovereignty of states. The commission's work at its fifth session clearly revealed these tendencies. Thus, for instance, a draft convention on international arbitration was drawn up. This draft in no way respects the principles recognized in this field; it institutes a system of legal arbitration which, although binding on the states, accords very extensive powers to the courts and gives the International Court of Justice the possibility of participating in the procedure. Further, the commission drew up three draft conventions relating to the regime of the high seas, including one on fishing under which the establishment of an international organization was proposed. Such a project seems unacceptable to the authors for these questions should be settled exclusively by negotiations between the states concerned. Lastly, a convention on the status of stateless persons was envisaged. The Soviet representative objected to the very principle of such a convention, pointing out that the problems of nationality and stateless persons fell within the exclusive competence of the national legislature concerned. Thus, in almost all fields, the commission was inspired by the principle of the supremacy of international over domestic law. Nevertheless, it must be pointed out that satisfactory results were achieved with regard to certain matters, such as the agreement on the 'continental shelf'.

BIN CHENG. 'International Law in the United Nations', *The Year Book on International Affairs* 8, 1954, p. 170-95.

The United Nations contribution to the progress of international law is far from satisfactory. The political compromises on which the organization is based and the heterogeneous nature of the international community explain, but do not justify, the indifference to legal questions and the numerous violations of the rules of law which characterize the organization's activities. The *de facto* revision of the Charter is one of the most striking examples of this attitude. Moreover, the International Court of Justice's jurisprudential innovations, especially in the absence of adequate reasons to justify them have increased the reluctance of states to subject themselves to a court whose judgments cannot be reasonably predicted. It can be concluded that, under the cloak of the United Nations, most governments have utilized international law as a mere tactical resource, and have adhered to the principle of national sovereignty and the policy of force whenever legal solutions did not coincide with their own interests.

JESSUP (P. C.). 'Should International Law recognize an Intermediate Status between Peace and War?', *The American Journal of International Law* 48(1), January 1954, p. 98-103.

The 'cold war' has emphasized an already long-established fact: between openly declared warfare and true peace there is an intermediate situation, characterized by practices which are not pacific but which are difficult to describe as acts of war. But international law and the United Nations Charter refer only to the absolute notions of peace and war. It is not, therefore, paradoxical to maintain that a revision of the Charter which introduced legal recognition of this intermediate state of affairs would improve a legal system that at present reflects, not the existing situation, but a period of history which is already closed.

TSOUTSOS (A. G.). 'Le principe de la légalité dans l'ordre juridique international (A propos d'une révision de la Charte)', *Revue hellénique de droit international* 7(1), January-March 1954, p. 35-44.

The occasion of the reviewing of the United Nations Charter should be used to seek means of improving international organization as far as possible. In general, international law should be given the benefit of the progress achieved in the techniques of domestic law. In particular, the principle of legality should be applied, with all its consequences, to international law. A considerable gap would be filled, internationally, by the establishment of effective means of appeal against the decisions of international bodies. Moreover, precedents exist: the Versailles Treaty, the Statute of the Danube, the European Coal and Steel Community, and the Havana Charter all provide for appeals to special bodies or to the International Court of Justice. The establishment of the legality or otherwise of international juridical acts is therefore not impossible; but a bold reform will have to be carried out in this field if it is desired to overcome the judges' reluctance to settle disputes which are often of a political character.

REVIEWING OF THE CHARTER

CASTREN (E.). 'Révision de la Charte des Nations Unies', *Revue hellénique du droit international* 7(1), January-March 1954, p. 20-34.

It is difficult not to admit the need for a revision of the United Nations Charter; but it must be pointed out that such a revision would involve many dangers, especially that of a scission in the event of unanimity not being reached on the reforms to be effected. However, it is possible that, on the basis of mutual concessions, an agreement may be reached at the Revision Conference. Numerous points will fall to be discussed. With regard to principles, it will be necessary to define what is implied by the sovereignty of Member States other than the Great Five, in order to ensure a greater degree of justice. It will also be necessary to define the nature of the 'matters which are essentially within the domestic jurisdiction of any state', and to resolve the question of the admission of new members, so that the organization shall be genuinely universal. From the institutional standpoint, several procedural questions will have to be settled—in the first place, that of the right of veto in the Security Council. Lastly, it will be necessary to examine closely the provisions of the Charter relating to the settlement of international disputes: the ideas of 'threats to the peace', 'breaches of the peace', 'acts of aggression' and 'the right of lawful collective defence' will, in particular, have to be clearly defined.

MORGENTHAU (H. J.). 'The New United Nations and the Revision of the Charter', *The Review of Politics* 16(1), January 1954, p. 3-21.

The 'cold war' and the latent conflict between the great powers have led to a radical transformation of the United Nations. The powers of the Security Council have diminished, whereas the authority of the General Assembly has increased. The United Nations has, in the author's view, gradually become an international government opposed to the Soviet bloc, and little remains of the edifice constructed at San Francisco, although the institutional framework has not changed. Must we conclude that a revision of the Charter has become inevitable? This Charter, although infringed on all sides, still remains the fragile symbol of peaceful co-existence between East and West; its suppression would be tantamount to abolishing the 'universality' of the United Nations. Even if it has become no more than a symbol, it would be useful and wise to preserve it.

'United Nations Charter Review', *Current Notes on International Affairs* 25(1), January 1954, p. 35-42.

The nearness of the date fixed by the United Nations Charter for a General Conference to review the Charter lends particular interest to the procedure established by Articles 108 and 109. The position of the governments can be inferred from the declaration made during 1953 by a number of delegates, and from the reception given to

the proposals concerning preparatory work formulated during the eighth session of the General Assembly.

YUEN-LI-LIANG. 'Notes on Legal Questions concerning the United Nations: Preparatory Work for a Possible Revision of the United Nations Charter', *The American Journal of International Law* 48(1), January 1954, p. 83-97.

At its eighth session, the United Nations General Assembly had before it several proposals concerning preparatory work for a possible revision of the Charter. These proposals, which were submitted to the Assembly's Sixth Committee, included the following: the publication of the unpublished documents relating to the San Francisco Conference; the establishment of a general index of this documentation; the preparation of a repertory of the decisions taken and of the practices followed by the various organs of the United Nations; the drafting of a constitutional history of the United Nations; the setting up of an Advisory Committee to assist the Secretary-General in the study of possible reforms; and lastly, consultations with Member States on the particular amendments which they would like to be discussed at the General Conference in 1955. These proposals raised numerous legal and political objections. In fact, some of them seem to be contrary to the procedure for revision prescribed by Article 109 of the Charter. Accordingly the General Assembly, sharing the opinion of the Sixth Committee, finally decided by a very large majority to approve only the first three proposals, i.e. the only proposals whose objectivity could not easily be contested.

MOLODTSOV (S. V.). 'Pravilo jedinoglasia postojannykh členov Soveta Bezopasnosti nezyblemaja osnova OON' (The rule of the unanimity of the permanent members of the Security Council—Fundamental basis of the United Nations), *Sovetskoje Gosudarstvo i Pravo* (Moscow) 7, 1953, p. 44-57.

The principle of the unanimity of the permanent members of the Security Council was adopted, after lengthy negotiations, at the Yalta Conference (Crimea) in 1945. The second world war had shown that only permanent agreement and close co-operation between the great powers could safeguard international peace and security. The unanimity rule was intended to prevent the western powers from reverting to the definitely anti-Soviet policy which they had followed before the war; it by no means constituted an exception to the principle of the legal equality of states: the great powers, which, owing to their responsibility for the maintenance of peace, had special obligations, could claim certain privileges in return. However, from 1946 onwards, the United States and the countries under their influence launched an offensive against the principle of unanimity. Whereas—in the author's view—the Union of Soviet Socialist Republics used its recognized right solely in order to oppose resolutions contrary to peace and security or contrary to the Charter, the United States, according to the writer, endeavoured in various ways to circumvent the unanimity rule; the establishment of the 'Interim Committee' of the General Assembly, the efforts to limit the interpretation of the principle, the non-admission of the People's Republic of China to the Security Council, the illegal decisions taken in the absence of the Soviet delegate, the proposals for a reform of the Charter, involving abolition of the unanimity principle—all these are examples of this policy, which risks weakening the United Nations' authority. In fact the unanimity rule is essential to the proper functioning of the United Nations, and its abolition or limitation would threaten the organization's very existence.

INTERNATIONAL CIVIL SERVANTS

SCOTT (F. R.). 'The World's Civil Service', *International Conciliation* 496, January 1954, p. 259-320.

With the League of Nations and subsequently, on a much wider scale, with the United Nations and its specialized agencies, an entirely new category of administrative staff came into existence—the international civil servants. In some respects, their status resembles that of diplomats; in others, that of national civil servants. In fact, the international public service has its own exigencies, which are reflected in the status

of its officials. The latter must, above all, be the loyal servants of the international organization to which they belong, even if this obligation runs counter to the loyalty that they owe to their respective nations; they must also be independent of all governments. Further, it is desirable that international civil servants be recruited on the broadest possible geographical basis, that normal career conditions be offered them, and that they accept the responsibilities attaching to their mission. Lastly, international civil servants enjoy certain privileges and immunities, without which they would be unable to fulfil their functions properly. Many concrete problems remain to be solved, such as that of the relations between an international organization and the host nation. It is clear, however, that a body of administrators devoted to the international ideal already exists. This positive result materially compensates for the technical and legal imperfections of a status that is still in course of evolution.

HONIG (F.). 'The International Civil Service: Basic Problems and Contemporary Difficulties', *International Affairs* 30(2), April 1954, p. 175-85.

Not all problems raised by the status of international civil servants have been solved by the United Nations Charter. The recent difficulties in the relations between the Secretariat-General and the United States Government, and the confusion still subsisting about the actual nature of the privileges and immunities of the United Nations staff, clearly show that the compromise reached at San Francisco is far from being accepted unreservedly. Present events endanger the very idea on which the status of international civil servants is based—namely, their independence *vis-à-vis* the governments of Member States. The effectiveness of the United Nations Secretariat depends on this basic principle, which should be reaffirmed when a new revised code of privileges and immunities, radically different from those enjoyed by diplomatic agents, is submitted to the states for ratification.

JORION (E.). 'Les droits et obligations des fonctionnaires internationaux', *Revue internationale des sciences administratives* 1, 1954, p. 149-69.

The decisions taken by the United Nations Secretary-General with regard to members of the organization's staff suspected of subversive activities against the American Government have raised, in a unprecedentedly acute form, the problem of the independence of international civil servants. The advisory opinion asked from Professor H. Rolin by the Federation of International Civil Servants' Associations makes an interesting contribution to the discussion. Professor Rolin considers that the Secretary-General's freedom of recruitment cannot be hindered by any unfavourable information which a government may communicate to him with regard to a given candidate; that neither the fact of belonging to a legal political party, nor the fact of having invoked a constitutional privilege excluding self-incrimination, is incompatible with the status of international civil servants; that the Secretary-General cannot, except in quite special circumstances, dismiss a member of the secretariat on the ground of mere presumptions, and that the fact of an international civil servant having refused to comply with a subpoena cannot be regarded as misconduct unless such refusal is detrimental to the interests or prestige of the organization. On all these points, Professor Rolin gives a concrete interpretation of the guarantee of independence contained in the Charter, though he draws attention to the main practical difficulties involved in their application. His conclusions seem to be unexceptionable save in regard to certain points of detail.

TECHNICAL ASSISTANCE

'Postwar International Aid Programmes: (1) The Regular Programme of the U.N. Technical Administration', *Current Notes on International Affairs*, 25(2), February 1954, p. 123-33.

The great increase in the number of international aid programmes makes it necessary to recapitulate the origins and objects of the most important of them: the 'regular' programme of the United Nations Technical Assistance Administration, the 'expanded' programme of technical assistance and the mutual aid (Point IV) plans.

The United Nations Technical Assistance Administration was established in 1950 in order to co-ordinate the activities of the United Nations, its specialized agencies and Member States. We can group these activities under three main headings (economic development, public administration and social progress), and analyse their methods, results and cost.

WOHL (R.). 'Technical Assistance: Retrospect and Review', *Bulletin of the Atomic Scientists* 10(3), March 1954, p. 75-80.

The Western world has very quickly lost its illusions about the rapidity and spectacular nature of the results expected from technical assistance. In fact, technical assistance is a very long-term task, requiring considerable capital. It must be modest in its aims and limit itself to guiding the countries concerned along the path of economic development. Results such as those achieved by Horace Holmes in the Indian district of Etawah exactly correspond to this definition. Technical assistance really depends on the experts who have to advise the governments of underdeveloped countries and carry out pilot projects. They must show disinterestedness and tact as well as technical ability; they must overcome difficulties due to atmospheres or civilizations very different from, or even hostile to, their own. Technical assistance rests on this very narrow basis, owing to lack of the abundant public and private investment that was anticipated; it is undoubtedly resulting in valuable progress, but we must not expect miracles from it.

PANCOAST (D. B.). 'The "Point Four" Policy', *Bulletin of the Atomic Scientists* 10(3), March 1954, p. 87-92.

Technical assistance, the need for which is now generally recognized, must be envisaged as a form of international co-operation with a view to the development of the so-called economically underdeveloped countries. It is not simply a question of providing these countries with merchandise or capital, still less of annexing them to such-and-such a political region. The results achieved in Iran clearly illustrate the co-operative aspect of the undertaking, as well as the important role which is left to the initiative and efforts of the peoples concerned. It is in this spirit that combined programmes of development can and must be applied in the various fields covered by technical assistance, more particularly in agriculture and natural resources, health and hygiene, education, industry and government. In this respect, the programme established for Egypt is outstanding; the Point IV Administration has really taken charge of the development of the Egyptian people. Point IV constitutes the most effective part of American foreign aid, and it is for that reason that it must be supported.

MALIK (C.). 'Some Reflections on Technical and Economic Assistance', *Bulletin of the Atomic Scientists* 10(3), March 1954, p. 93-96.

The Industrial Revolution created a gulf difficult to bridge between the peoples of the West and those of the so-called underdeveloped territories. Humanitarian considerations, combined with the increasing demand for raw materials and the need to fight against communist expansion, impose an obligation upon the peoples who enjoy the highest standards of living to raise the level of their less fortunate fellow men. There are many obstacles to surmount; considerable sums must be invested in the areas to be assisted, ideological hostilities have to be overcome and technical processes adapted to differing conditions. But the main difficulty—one to which insufficient attention has so far been paid—is how to bring about that mental readjustment without which the peoples assisted can never change from their present primitive stage of civilization to modern industrial civilization. They must be brought to make this change themselves, in such a way as to integrate themselves afresh into the human community from which they feel excluded.

MEIER (R. L.). 'Automatic and Economic Development', *Bulletin of the Atomic Scientists* 10(4), April 1954, p. 129-33.

None of the schemes for the underdeveloped countries seems to have taken sufficient account of the notion that a country's economic development can be considerably

furthered by the use of the latest automatic processes in industry. The influx of labour from the country to the new industrial towns would be appreciably reduced by such use; and foreign capital would be more readily invested in industries employing automatic methods—electric power, electronics, etc.—than in the older type of enterprise, which calls for a large labour force involving high running costs. But this conception, although perhaps productive of more rapid economic development, encounters many obstacles which have to be surmounted, such as the difficulty of training native engineers, and hostility from local ideologies (such as that of Gandhi).

NON-SELF-GOVERNING TERRITORIES

CHARMIAN EDWARDS TOUSSAINT. 'The United Nations and Dependent People', *The Year Book of International Affairs* 9, 1954, p. 141-69.

Since 1946, the sharp distinction drawn by the Charter between trust and non-self-governing territories has in practice been much attenuated, according to the writer, despite the colonial powers' hostility to this development. While troublesome problems of definition and competence have arisen all through the period, the main source of friction is this departure from 'original status', which will be a subject of major controversy if revision of the Charter is undertaken in 1955. The fact that representatives originating from the territories administered take part in the organization's work has also helped to change the conditions in which Chapter XI is applied. Further, the provisions made for controlling the administration of trust territories have revealed the gravity of the tensions between anti-colonial nations and imperial powers—tensions which, although unconnected with those producing the cold war, have been skilfully used by communist propaganda.

KUNZ (J. L.) 'Chapter XI of the United Nations Charter in Action', *The American Journal of International Law* 48(1), January 1954, p. 103-10.

While it is questionable whether the trusteeship system instituted in Chapters XII and XIII of the United Nations Charter is an advance on the League of Nations mandatory system, Chapter XI, which defines Members States' duties towards non-self-governing territories, represents such a completely new conception that some authors see it as a veritable charter of colonial administration. Yet Articles 73 and 74 are regrettably vague; the very term 'non-self-governing territories' is ambiguous, so that the colonial powers remain to a great extent free to interpret it as they will. The impassioned controversies aroused by attempts to define this term reflect the violence of the ideological conflict between on the one hand the colonial powers and, on the other the peoples they administer, together with the nations which for different reasons champion anti-colonialism.

REFUGEES

WEIZ (P.). 'The International Protection of Refugees', *The American Journal of International Law* 48(2), April 1954, p. 193-221.

The refugee problem arises not only in a material, social and psychological but also in a legal context—refugees should be protected by law. While many states have extended guarantees unilaterally to refugees living on their territories, the 1951 Convention regarding the status of refugees enabled these rules to be unified and incorporated in international law. The role of the international specialized agencies in this development was particularly decisive and effective, and the system of practical protection, both legal and political, which they have built up is noteworthy for the fact that it regards certain individuals as directly covered by international law.

INTERNATIONAL COURT OF JUSTICE

ROLIN (H.). 'The Court and Domestic Jurisdiction: Notes on the Anglo-Iranian Case', *International Organization* 8(1), February 1954, p. 36-44.

The Anglo-Iranian conflict, which was brought before the Court of International Justice in 1951, once more raised the problem of the Court's scope and competence. Article 2(7) of the United Nations Charter in fact institutes a 'private domain' lying outside international jurisdiction. What is the real extent of this domain? It seems that it must include all matters not normally covered by the Law of Nations, or not generally the subject of international negotiations. Yet, when a country signs a bilateral convention on a matter normally within its private domain, it retains the right to invoke Article 2(7), unless by the terms of the convention it has specifically surrendered this privilege. In any case, international organizations are permitted to intervene in the private domain of a country which is manifestly abusing its recognized privileges; but there can be no question that the reservation made by the United Nations Charter is applicable to the competence of the International Court of Justice.

HUDSON (M. O.). 'The Thirty-second Year of the World Court', *The American Journal of International Law* 48(1), January 1954, p. 1-22.

The chief judgments given by the International Court of Justice in 1953 relate to the Ambatielos case, the Anglo-French dispute over the Minquiers Islands, and the Nottebohm case. Two new disputes were also brought before the Court; in the first, Italy opposed Great Britain, the United States and France on the subject of the gold seized in Rome in 1943, and the second case was a dispute between France and the Lebanon with regard to the Electricité de Beyrouth company. In addition, the General Assembly submitted the following legal point to the court: would a refusal to vote the sums necessary for payment of the compensation awarded by the United Nations Administrative Tribunal to the officials whom the Secretary-General dismissed constitute an illegal decision? Finland deferred to the Hague Court's decision in its dispute with Sweden and Norway. Japan and the Republic of San Marino asked the Secretary-General of the United Nations on what conditions they might accede to the Statute of the Court.

KOPELMANAS (L.). 'La notion de la liberté économique devant la Justice internationale', *Journal du droit international* 81(1), January, February, March 1954, p. 64-107.

The judgment given on 27 August 1952 by the International Court of Justice on the rights of United States citizens in Morocco raised international problems of infinitely greater importance than the material interests motivating it. Based on certain factual considerations, the French argument set out to prove that the control exercised over commercial operations in Morocco was compatible with economic freedom and the principle of equal conditions. The American argument, on the other hand, tried to establish that control was exercised in such a way as to discriminate against foreigners, and amounted simply to restrictive control over foreign imports. The court gave a highly questionable decision, condemning the French attitude as discriminatory and thus accepting the American case. In this dispute, as in the fisheries case, it put legal tradition and established usage above economic necessity. The position adopted by the court, which is not necessarily open to criticism, reveals a serious shortcoming in the legal machinery for solving international disputes of an essentially economic character, and one which could only be remedied by a system of international arbitration.

SPECIALIZED AGENCIES

INTERNATIONAL LABOUR ORGANISATION

WOLF (F.). 'Le tribunal administratif de l'Organisation Internationale de Travail', *Revue générale de droit international public* 25(2), April-June 1954, p. 279-314.

The Administrative Tribunal of the International Labour Organisation—the successor of the League of Nations Administrative Tribunal created in 1927—operates on bases

laid down in 1946. Its statute introduces several important new features, such as the extension of its competence to disputes arising out of contracts to which the ILO is a party, recourse to the Tribunal free of charge, and the institution of procedure for appeals to the International Court of Justice. Although the 1946 statute considerably modifies the earlier one of 1927, the case decisions of the League of Nations Tribunal have not thereby been deprived of any of their weight, as the ILO Tribunal has clearly shown in several of its recent judgments. Adopting the same principles of equality and impartiality as its predecessor, and acting for six international organizations, it is making a very material contribution to the building up of a body of international administrative law.

INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT

ROSSI (R.). 'The World Bank', *Economic Review* (Helsinki) 1, 1954, p. 10-18.
Although there is no question that, in the minds of the promoters of the International Monetary Fund and the International Bank for Reconstruction and Development, the Fund held priority of place, the Bank, encountering fewer obstacles, has certainly secured more practical results. This is due not only to the considerable funds at its disposal, but to the definite bounds set to its objectives and the prudence with which its activity has been conducted. The loans made to Finland, for instance, are a good example of the general policy followed by the Bank.

INTERNATIONAL MONETARY FUND

GOLD (J.). 'The Interpretation by the International Monetary Fund of its Articles of Agreement', *The International and Comparative Law Quarterly* 3, April 1954, p. 256-76.
Article XVIII of the Agreement establishing the International Monetary Fund prescribes that the legal interpretation of these Articles should rest with the Fund itself. This provision, which is comparatively rare in the statutes of international organizations, raises some delicate problems, especially regarding the extent to which the Fund's interpretative decisions are binding upon national and international courts and tribunals. It should also be pointed out that Article XVIII has only in practice been utilized five times since 1946. Most of the interpretation needed in this institution's work has in fact taken the form of simple decisions which, because they are less formal, are not irrevocably binding on Member States.

FOOD AND AGRICULTURE ORGANIZATION

BLAU (G.). 'Écoulement des excédents de produits agricoles', *Bulletin mensuel. Économie et statistiques agricoles* 3(5), May 1954, p. 1-17.
The problem of disposing of surplus crops was one of the major preoccupations of the Conference of the Food and Agriculture Organization at its seventh session. The conference faced the problem boldly and advocated the adoption of energetic policies for raising consumption. Instead of merely fighting the effects of surplus production by destroying unwanted stocks or setting them apart, we should investigate the causes and try to eliminate them. Three main methods of putting a permanent end to surpluses seem indicated: the holding or reserving of stocks, the adoption of measures to expand markets, and a limitation of the quantity of new crops offered. These methods, if honestly applied, should produce a state of balance in supply and demand in food products that would be satisfactory to consumers.

WORLD HEALTH ORGANIZATION

VONCKEN (J.) and LA PRADELLE (P. de). 'L'Organisation mondiale de la médecine', *Revue des deux mondes*, 15 May 1954, p. 331-41.
On 20 May 1953, during its sixth session in Geneva, the World Health Assembly adopted a resolution inviting the Director-General of WHO to undertake a preparatory

study of the problems relating to International Medical Law and Comparative Health Legislation. Begun some twenty years ago under the aegis of the Medico-Legal Commission of Monaco and other national institutions, the elaboration of this law has so far progressed very slowly. Owing to the lack of adequate sanctions, the principles laid down were barely respected at all during World War II. Further, there are still important gaps. The new International Medical Law will have to establish the status of doctors in time of war, as regards not only their professional activity but also their personal security. Equal attention will have to be paid to the problems raised in peace time by the practice of medicine in modern societies in process of evolution. Only the effective world organization of medicine can ensure for doctors the legal and moral security which they need.

UNITED NATIONS EDUCATIONAL, SCIENTIFIC AND CULTURAL ORGANIZATION

TRIPP (Brenda M. H.). 'Unesco in perspective', *International Conciliation* 497, March 1954, p. 323-83.

Since the end of the eighteenth century, the dissemination of national cultural activities has played an increasing part in governments' foreign policies. The efforts made in this direction have helped to emphasize the value of international co-operation in the intellectual field. This task, which before the last world war was entrusted to the International Institute of Intellectual Co-operation, is now being carried out by the United Nations Educational, Scientific and Cultural Organization. Unesco's aim is not only to promote cultural exchanges, but also to facilitate international understanding in order to create the necessary conditions for the establishment of a peaceful international community. In the field of education, for instance, Unesco has not merely taken part in reconstituting the material resources of education in the war-damaged countries; it has also endeavoured to promote educational methods calculated to develop a feeling of international solidarity. Likewise, it has emphasized the importance of the peoples' common cultural heritage, and tried to ensure that scientific discoveries are used for improving humanity's standard of living. Such an ambitious undertaking was bound to result in certain errors and give rise to a good deal of criticism; but the success so far achieved] is encouraging, having regard to present political divisions in the world. From the experience of the last seven years, Unesco must draw conclusions which will enable it to make its work even more effective.

ELVIN (L.). 'Education and Peace', *India Quarterly* 10(1), January-March 1954, p. 31-39.

Unesco's fundamental aim—to create, through education, the psychological conditions for a peaceful international community—certainly seems more difficult to achieve today than in 1946. But the United Nations' task is not to suggest, contrary to the evidence, that international solidarity is already an established fact; it is simply to promote, through education, this idea of solidarity and co-operation. This task involves no radical addition to, or amendment of, school curricula; nor does it imply the application of a uniform method for all countries. What is important is not so much the subject-matter taught as the spirit in which the teaching is given. By inculcating in the child, from its earliest school days, the habit of respecting the beliefs and personalities of all the other schoolchildren, as well as a desire to get to know children and grown-ups in neighbouring countries, the teacher will help to develop in his charges a spirit of tolerance and understanding. Developed in each class and at every educational level, Unesco's work can thus gradually lead to that 'peace in the minds of men' without which there can be no world peace.

WRIGHT (Q.). 'The Psychological Approach to War', *India Quarterly* 10(1), January-March 1954, p. 23-31.

It seems just as artificial to regard the individual and society as two radically different entities as to endeavour to 'amalgamate' them. That is why it is necessary to have simultaneous recourse to psychology and sociology in order to understand the elements of a problem such as that of peace. Consequently, the United Nations must carry out

two tasks at one and the same time—a sociological task, which consists in laying the bases of an international political order, and a psychological task, consisting of preparing men's minds for it. This second aim, which is prescribed in Unesco's constitution, calls for special attention. The preparation of educational programmes must be preceded by efforts to ascertain the basic psychological tendencies that are likely to lead to aggression. A better understanding of the behaviour of men and peoples is in fact a necessary, if not a sufficient, condition for a peaceful international society.

INTERNATIONAL CHILDREN'S EMERGENCY FUND

SINCLAIR (A.). 'Travaux et réalisations du Fonds des Nations Unies pour l'enfance', *Affaires extérieures* 6(2), February 1954, p. 49-54.

Established in December 1946 by the United Nations, the International Children's Emergency Fund was originally intended for war-devastated areas. From 1950 onwards its activities were mainly devoted to underdeveloped countries, as part of close co-operation with international organizations concerned with the social aspects of technical assistance. ICEF, in addition to obtaining considerable results in the struggle against various diseases (such as tuberculosis, yaws and malaria), has achieved great success in the establishment of maternity and infant health centres and in the organizing of nutrition campaigns. Humanitarian in inspiration, the task undertaken has an undoubted economic value, especially because of the increase in individual output among workers who benefit by it. This alone should induce all governments to give ICEF increased financial help.

GENERAL AGREEMENT ON TARIFFS AND TRADE

GORTER (W.). 'GATT after Six Years: An Appraisal', *International Organization* 8(1), February 1954, p. 1-18.

Based on a compromise, the General Agreement on Tariffs and Trade (GATT) demands sacrifices on the part of each signatory state. After six years of its existence, we can endeavour to determine how far GATT has achieved its objects, and more particularly how far it has contributed to the development of multilateral trade. The actual clauses of the Agreement, which provide for numerous exceptions to the obligations imposed on Member States, would not seem to constitute any very material progress towards the removal of trade restrictions. In practice, however, GATT has led to a clear reduction in customs tariffs. Admittedly it has had no influence on quantitative restrictions; but, if only because it has compelled each nation to submit its trade policy to public criticism and has made an organized exchange of information and opinions possible, GATT represents the first step towards rational international co-operation in the matter of tariffs and trade.

BOOK REVIEWS

INTERNATIONAL ORGANIZATION

BORGESE (G. A.). *Foundations of the World Republic*. The University of Chicago Press, Chicago, 1953, 8vo, xi + 328 p., index.

Three main themes—Peace, Justice and Power—form the basis of the author's plea for a world republic. A world government is inevitable. Will it be imposed by the victor of a third world war, or built up peaceably on the foundations of the United Nations? This second hypothesis is not utopian. The preparation of a draft world constitution

can, in this respect, play an important part. Far from being a mere intellectual game, it is a necessary stepping stone on the way, and can be a driving idea capable of rallying people of goodwill.

Guide to International Organizations. I: Governmental Organizations. London, Central Office of Information, 1953, 8vo, unpaginated, multigraphed.

This work is the first part of a descriptive analysis of international organizations. It studies 70 commissions or other bodies of a governmental nature and, according to a uniform plan, provides essential information about each of them (headquarters, administration, member countries, history, aims, structure and principal activities). These short studies are arranged alphabetically in loose-leaf form, so that they can be brought up to date and added to by periodical supplements.

SBAROUNIS (A. J.). *Taxation of the United Nations Officials.* Separate reprint from the *Revue hellénique de droit international* 1, 1954, Athens, 1954, 8vo, 24 p.

The 1947 Convention on Privileges and Immunities, which certain states have not ratified, stipulated that member countries should not subject the emoluments of United Nations officials to taxation. At the same time the General Assembly asked the Secretary-General to work out a scheme for compulsory contributions to be made to the United Nations by members of its staff. But neither of these decisions has provided a final solution for the problem of the taxation of international civil servants. The main conclusions to be drawn from an analysis of the social, political and legal aspects of the question are that international civil servants cannot be assimilated to diplomatic agents for the purpose of tax exemption, and that there is no legal basis for the contribution at present levied by the United Nations upon its staff.

SPECIALIZED AGENCIES

DESPRES (J.-P.). *Le Canada et l'Organisation Internationale du Travail* (Canada and the International Labour Organisation). Montreal, Fides, 1947, 8vo, 276 p., no price quoted, bibliography.

While dealing primarily with the history of Canada's relations with the International Labour Organisation, this work by one of the Organization's senior officials presents a very useful picture of its constitution and operation. After describing the origins and early days of ILO, the author explains the position of federal states under the organization's constitution, and shows how it has evolved since 1919 in the particular case of Canada. In conclusion, he considers the new tasks which have fallen to the ILO since the end of World War II. An annex includes the text of the ILO's constitution.

VERNANT (J.). *Les réfugiés dans l'après-guerre* (Refugees in the post-war period). Monaco-Ville, Éditions du Rocher, 1954, 8vo, 922 p., no price quoted, bibliography.

This close-knit and well documented work is the fruit of two years' world-wide research and inquiry into refugee problems, whether or not these fall within the province of the United Nations High Commissioner's Office. In a general introduction the author defines the term 'refugee' as now used, records the work of the international bodies concerned with refugees since World War I, and shortly describes the various categories of refugees characteristic of the period subsequent to World War II. The remainder of the work consists of an account of the position of refugees in each of the recipient countries, which are divided into six groups according to their geographical situation and the capacity for receiving refugees. In each instance, an introduction, describing the general elements of the problem, is followed by an account of the principal legal provisions governing the status of refugees in the country concerned, and a factual description of their economic and social situation. This informative and objective work formulates no conclusions; it leaves it to the reader to draw his own.

INTERNATIONAL CO-OPERATION

JOYCE (J. A.). *World in the Making: The Story of International Co-operation.* Henry Schuman Inc., New York, 1953, 8vo, 159 p., bibliography, index.

There are three distinct stages in the history of civilization. The first was marked by the foundation of the modern state and the growth of the idea of national sovereignty. The second, which only really began in the nineteenth century, saw the advent of great international administrative bodies and of world unity on the material plane, despite the artificial divisions created by frontiers. The last stage began with the League of Nations; with the coming of the United Nations, it reveals the outline of a world government, which is no longer a utopian vision.

SNYDER (H. E.). *When Peoples speak to Peoples: An Action Guide to International Cultural Relations for American Organizations, Institutions and Individuals.* Washington, American Council on Education, 1953, 8vo, xiv + 207 p., index.

The work undertaken by voluntary organizations, since the end of World War II, to rebuild the educational systems in devastated and occupied countries is well revealed by the activities of the two co-ordinating commissions—the Commission for International Educational Reconstruction and the Commission on the Occupied Areas—over which the author of this volume presided. Summarizing these activities, in which the American Government and Unesco both took part, Mr. Snyder stresses the importance of the human factor in international relations. He evolves, on this basis, a veritable guide to action for all associations or individuals concerned with the question of international cultural relations. He also draws attention to certain somewhat neglected aspects of the problem of cultural relations, showing how failure to study them has led to the nullification or inadequacy of many government or private schemes.

Report of the Special Study Mission on International Organizations and Movements of the Committee on Foreign Affairs. United States Government Printing Office, Washington, 1954, 8vo, xiv + 240 p.

Three members of the Foreign Affairs Committee of the House of Representatives carried out a survey of international bodies in Europe. Their subsequent report contains practical information on the offices and specialized agencies of the United Nations in Rome, Geneva, Berne and Paris, and on the other international bodies (GATT, ICEM) to which the United States of America belongs. The second part of the report deals more especially with the problems of 'European integration' and the third with the Hispano-American agreements. Particular attention is paid to the questions raised by America's membership of and activity in international organizations.

BOCK (E. A.), *Fifty Years of Technical Assistance. Some Administrative Experiences of U.S. Voluntary Agencies.* Chicago, Public Administration Clearing House, 1954, 8vo, x + 65 p., bibliography, $1.50.

An elaborated version of a working paper prepared for a conference on the social aspects of technical assistance programmes, which was held in New York in April 1953 under the auspices of the United Nations and Unesco, this monograph sums up the results of the efforts put forth by the United States of America in the last 50 years to aid the development of the so-called 'backward' countries. Replies which 66 American specialists in private technical assistance returned to a questionnaire have enabled the author to identify the main aims (health, education, agricultural development) of the groups concerned, and to describe their methods as regards both the selection of these aims and the organization of their work or relationships with the countries assisted. Concentrating as it does on personal relations and organizational problems, this study throws an interesting light on the importance of the administrative side of technical assistance.

Recueil de textes relatifs à l'organisation du Traité de l'Atlantique Nord (Compilation of texts regarding the North Atlantic Treaty Organization), Paris, La Documentation Française, 1953, folio, 180 p., no price quoted.

This compilation, No. 25 in the series *Recueils et monographies* published by La Documentation Française, was produced by the Documentation Centre of the Press and Information Service in the French Ministry of Foreign Affairs. A 'procedural' table and a 'chronological' table are followed by the main documents—treaties, conventions, official communiqués, declarations by statesmen, diplomatic notes and memoranda—relating to the defence of the North Atlantic and dating from March 1948, the month when the Brussels Treaty was concluded, to 30 May 1953, when General Ridgway's report was made public.

INTERNATIONAL LAW

KUHN (A. K.). *Pathways in International Law; A Personal Narrative*. New York, The Macmillan Company, 1953, 8vo, 240 p., index.

For more than 50 years, the author has played an active part in all endeavours to improve international law. Convinced that the peaceful co-existence of the nations is impossible in the absence of a stable international legal system, Mr. Kuhn has had occasion—as lawyer, teacher, member of the International Law Association, editor of the *American Journal of International Law*, or delegate to several international conferences—to co-operate at first hand in the development of international law since the beginning of the twentieth century. His book not merely provides factual information on this vital period, but shows the extent to which one man's determination can hasten progress towards the ideal of international justice. Much ground remains to be covered before that ideal can be translated into reality, though the creation of international institutions undoubtedly constitutes a decisive step forward. Concrete achievement must however wait upon the establishment of the principle that, in most cases, international problems must be the subject of legal and rational rather than of political and empirical solutions.

Law and Politics in the World Community. Essays on Hans Kelsen's Pure Theory and Related. Problems in International Law compiled and edited by George A. Lipsky. Berkeley, Los Angeles, University of California Press, 1953, 8vo, xx + 373 p., $6.

This volume, published as a tribute to Professor Hans Kelsen's legal work, contains contributions from seventeen of the most distinguished present-day specialists in international law. The first part, fairly technical in character, deals with certain basic problems such as the principle of efficacy, legal status, the state and regionalism in international law. The second part contains four articles on the United Nations, dealing with its legal nature, the political limitations to its action, and its Charter from the standpoint of international law and the protection of human rights. Finally, as 'special studies', there are six articles on problems more specifically connected with international law, such as treaty law in the Middle Ages, the international status of Austria, and the Geneva Conventions of 12 April 1949.

CHENG (Bin). *General Principles of Law as applied by International Courts and Tribunals* (*The Library of World Affairs*, 21), with an introduction by Georg Schwarzenberger. Published under the auspices of the London Institute of World Affairs. London, Stevens and Sons, 1953, 4to, lii + 490 p., bibliography.

Article 38, 1(c) of the Statute of the International Court of Justice prescribes that the court shall apply, *inter alia*, 'the general principles of law recognized by civilized nations'. This provision reflects a practice earlier followed by all international tribunals. Thorough study of their decisions enables us to discover exactly what the provision quoted implies, and to centre the general principles of law upon three main ideas. The first of these is summed up by the maxim '*Salus populi suprema lex*', which is no less important in international than in domestic law. The other two are the conceptions of 'good faith' and 'responsibility'. To these three ideas should be added the rules of

procedure generally accepted by modern states. There thus comes into being that international legal conscience which remains the source of all progress in law and justice in international relations.

SCHUMAN (F. L.). *International Politics. The Western State System in Mid-Century.* Maps by George D. Brodsky. Fifth edition. New York, Toronto, London, MacGraw Hill Book Company, 1953, 8vo, xviii + 577 p., with maps and folder map. Bibliography.

The fifth edition of *International Politics* brings up to date a work the last edition of which appeared in 1948.

Dealing with political history in the widest sense of the term, it not only describes events and institutions, but endeavours to interpret them systematically and to make a rational forecast of the future. Considerable space is devoted to international organizations (Chapter VIII) and to developments in international law. The world political situation would appear, not to demand that we should choose between world government and a third world war, but rather to produce the gradual unification of the free nations and the maintenance of a relatively peaceful state of equilibrium.

United Nations Textbook, Professor Telders, Study Group for International Law at Leyden University, Leyden, Universitaire Pers Leiden, 2nd ed., 1954, 12mo, 419 p., index.

This second edition of the work produced by the Study Group for International Law at Leyden University brings up to date the compilation of official texts relating to the United Nations, published in 1950. It is divided into four parts successively, with the history of the United Nations Charter; the Charter itself; the International Court of Justice; and the regional pacts, conventions and treaties referred to in Chapter VIII of the Charter. These texts and the accompanying annotations are so presented as to enable students of international law to use the work as a guide or manual.

Die Menschenrechte in christlicher Sicht (Human Rights from the Christian Standpoint), hrsg. von August Wimmer. Freiburg, Herder, 1953, 8vo, viii + 102 p. (2. Beiheft zur Herder-Korrespondenz).

The first meeting organized since the war by Pax Romana, the International Catholic Movement for Intellectual and Cultural Affairs, was held during Easter week 1951 at Limburg an der Lahn, and took as its theme the question of human rights. The speeches which were then made (and which the present booklet reproduces) approached this problem from every aspect—religious, philosophical and historical—before defining the legal framework in the shape of the guaranteeing of human rights by international organization or within the narrower ambit of the 'New Europe'. Several basic documents relating to human rights are reproduced in an annex: the Universal Declaration of Human Rights of 10 December 1948, the European Convention for the Maintenance of Human Rights and Fundamental Freedoms of 4 November 1950, and the final resolution adopted by the Limburg meeting.

LANDHEER (B.) and VAN ESSEN (J. L. F.). *Selective Bibliographies of the Library of the Peace Palace. I. Fundamentals of Public International Law.* Sijthoff's Publishing Company, Leyden, 1953, 8vo, 85 p., index.

This bibliography, the first of a series published by the Library of the Peace Palace, is devoted to basic books, booklets and articles on public international law. It covers only specifically legal publications, and its abstracting and classification are so designed as to simplify research. As this bibliography is deliberately confined to basic problems of international law, it does not deal with subjects that might be considered too specialized, such as international organization, the doctrine of national sovereignty, or the theory of international responsibility.

LANDHEER (B.) and VAN ESSEN (J. L. F.). *Selective Bibliographies of the Library of the Peace Palace. II. Recognition in International Law.* A. W. Sijthoff's Publishing Company, Leyden, 1954, 8vo, 28 p., index.

This second bibliography published by the Library of the Peace Palace gives a general idea of the publications devoted to the problem of international recognition. It is in eight parts, dealing with: the recognition of governments; the recognition of insurgents and belligerents; the legal consequences of recognition and non-recognition; the practice of recognition; the Stimson doctrine; recognition and admission of states by international bodies; and the recognition of governments in exile.

III. ANNOUNCEMENTS

INTERNATIONAL COMMITTEE FOR SOCIAL SCIENCES DOCUMENTATION

Meeting of 6-9 September 1954, Palais des Nations, Geneva

The meeting was attended by the following members of the committee: Messrs. A. C. Breycha-Vauthier (Austria), J. Meyriat (France), M. Hecksher (Sweden), P. Müller (Switzerland), K. Lipstein (United Kingdom), H. Lancour (United States of America); the following observers: Messrs. J. Goormaghtigh (Belgium), L. Bernot (France), S. R. Ranganathan (India), Landheer (Netherlands), R. Girod (Switzerland), Badr Kazem (Syria), H. Coblans (Union of South Africa), R. Phelps (United States of America); and representatives from several international organizations: the United Nations, the Economic Commission for Europe, Unesco, the International Labour Organisation, the World Health Organization, and the Carnegie Endowment for International Peace.

The committee met from 6 to 9 September at the United Nations Library. One meeting however, on 6 September, was held in the ILO building, thanks to the kind invitation of that organization's Director-General.

GENERAL ORGANIZATION OF BIBLIOGRAPHICAL ACTIVITY IN THE SOCIAL SCIENCES

The committee studied measures for ensuring better liaison between the bibliographies in the various disciplines with which it was concerned.

The majority of users had signified that they wished to have a special bibliography for their particular subject, directly corresponding to their purposes. They preferred not to have to resort too often to bibliographies of neighbouring disciplines, and they expected to find, in those they used, adequate information on publications which, while dealing with other sciences, had a bearing on their own research.

In these circumstances it was inevitable that certain titles should appear in several bibliographies. But these double mentions did not always amount to duplications, and the committee felt that there was no harm in resorting to them fairly systematically. They would be quite numerous, as the social sciences were relatively little differentiated one from another and in many respects overlapped.

The committee also considered that there should be co-operation with the editors of bibliographies other than social science ones, e.g. medical bibliographies. Such collaboration should facilitate the covering of marginal fields, such as the social aspects of health and hygiene problems. Greater attention should also be paid to other marginal or interdisciplinary questions, like town planning or labour problems.

The scope and features of these subjects, which did not come within one particular discipline alone, would appear more clearly if there were some general system of classification covering not merely social science problems as such, but all other questions that might be considered from a social science angle. It was recognized that none of the general classification systems currently in use fully met this need. It therefore seemed essential to lose no time in discovering the means for working out the system required. The work-plan contemplated would make it possible to utilize 'partial' systems which had already served for the preparation of several specialized bibliographies.

PERIODIC BIBLIOGRAPHICAL PUBLICATIONS

Several bibliographies coming within the committee's general programme, and already published, were thoroughly examined—namely, the *International Bibliography of Sociology*, the *International Bibliography of Political Science*, trend reports published in *Current Sociology*, the *International Political Science Abstracts*, and *Bibliografia juridica española* (Bibliography of Spanish Law). The committee also had before it the draft of the *International Economic Bibliography*, which was with the printer, and other recently completed manuscripts. It was therefore able to make special recommendations to the editors of these different bibliographies, and to arrive at certain more general conclusions. In particular, it advocated the continuation of efforts to broaden the field covered by these various bibliographies. The network of correspondents now being built up in many countries should be extended, so that the editorial secretariats could be assured of quick information as to all publications bearing on social science, whatever their country of origin. It also seemed advisable to develop the machinery for identifying and locating publications, with a view to tracing all interesting and really scientific articles that had appeared in general reviews or journals not specifically concerned with the social sciences. Lastly, it was decided that particular attention would be paid to official publications, which in all countries were increasingly taking on the character of publications of interest to scientists.

The committee repeated its view that unpublished doctorate theses were one of the most important forms of scientific expression. But in existing circumstances it did not consider it advisable that international subject-bibliographies should mention these, which in any event readers would have difficulty in procuring. However, it adopted a resolution inviting Unesco to consider keeping up to date its *Theses in the Social Sciences* (International Analytical Catalogue of Unpublished Doctorate Theses).

The committee studied a plan to publish a Social Sciences Yearbook, which would contain periodical reports on the progress achieved in each social science and would be such as to interest specialists in neighbouring disciplines. It hoped that this project could be carried out with assistance from the specialized international associations and the International Social Science Council.

The committee observed that socio-cultural anthropology was the only main social science which still had no general, international and periodical bibliography. It confirmed the decision already adopted by its bureau to undertake, in liaison with the appropriate international associations, the preparation of a new bibliography to fill this gap. It decided upon the measures that should make it possible to start carrying out this project as from 1956.

OCCASIONAL WORKS

The receptions given to the two draft 'basic bibliographies'—on political science and on economics—by specialists in the various countries enabled the committee to define more clearly how such works could attain their maximum usefulness. The conclusion was that the main effort should bear on the preparation, in contact with the appropriate international associations, of specialized, annotated bibliographies. More particularly, fields should be covered for which it was not possible to make trend reports; the latter were more elaborate and doubtless more useful, but were also more costly.

It was recognized that a cumulative list of works recommended in each field by the principal universities of the various nations would be of great practical use to small universities and professors and students in the so-called underdeveloped countries.

The committee also noted the work already accomplished by its secretariat for the execution of certain special projects, and gave directives for the continuation of this work. The following were the main projects in question:

1. Drafting of a social sciences section for a new edition of the *Index Bibliographicus*, on the basis of the 1952 edition. (This task is being performed in liaison with the International Federation for Documentation.)

2. Bibliography of social science works published from 1947 to 1953 in the various countries of South Asia, both in the vernacular and in the more widely-spoken languages. (This project is being carried out in close association with the Unesco Science Co-operation Office for South Asia.)
3. Preparation of an inventory of current national bibliographies of official publications in all countries, and the drafting of a study proposing rules for the improvement of this type of bibliography. (This work in being done at the request and with the aid of Unesco's Libraries Division.)

ORGANIZATION AND OUTSIDE CONTACTS

The committee decided to continue, permanently, a number of inquiries calculated to provide it with ever more detailed information as to the use made of existing bibliographies, and as to any gaps that remained to be filled in the way of specialized bibliographies.

This research should be accompanied by a *pari passu* effort to secure wider circulation for the committee's own publications; these did not yet by any means reach all the specialists to whom they could be of use. The position could, it seemed, be improved by combining better methods of commercial distribution with voluntary help from institutions and scholars that were interested in gaining a better knowledge of aids to their own fields.

The help of national correspondents in all countries would be increasingly useful to the committee, and it was accordingly decided to make a special effort to increase their number and, whenever possible, to put them in touch with each other.

The committee would also be justified in increasing its own membership, having regard to the expansion of its activities. But this could only be done if sufficient resources were available for the organization of meetings.

As certain members' terms of office were due to expire shortly, the necessary steps were taken for their replacement (by arrangement with the international associations). Finally, the committee fixed the dates of its next meetings; its bureau would meet twice in 1955 (in April and in the autumn), and the next plenary meeting would take place in the spring of 1956.

THE CONFERENCE ON RACE RELATIONS IN WORLD PERSPECTIVE[1]

Honolulu, July 1954

The conference, which was held on the campus of the University of Hawaii (Honolulu) during July 1954, was the occasion for a general survey of race relationship problems. The major interest was devoted to regions such as Hawaii, the United States and South Africa, which constitute a field for observation of particular interest. The importance of this meeting of specialists may be seen in the setting up of an international research ociety, whose president is Professor Franklin Frazier, and in the publication of two volumes containing the results of the conference.

One of the commissions set up during the meeting dealt with race problems in relation to industrialization and urbanization. This aspect of the subject is closely related to the objectives of the Research Office.

[1] Reprinted from *Information*, no. 2, 1954, published by the International Research Office on Social Implications of Technical Change.

In particular, the committee set out to formulate orientations for research. Some of the suggestions made are given below.

SPREAD OF INDUSTRIALIZATION AND URBANIZATION

The two most dynamic social processes of modern times are industrialization and urbanization. They have spread beyond national, cultural and ideological frontiers and have affected to some extent the major part of human society.

Whilst the majority of the peoples of the world do not work in a factory or live in a town, nevertheless, they are affected by factory-made products and by urbanization movements. With the spread of industrial civilization the number of individuals finding themselves placed in situations giving rise to conflicts and constraints will increase.

The social forces generated by these processes undermine traditional relationships, remake older ways of thought and action and develop new institutions.

The problems which have been suggested for research may be divided into two groups. Firstly, a fundamental distinction exists between problems which are more particularly economic in character and those which are more specifically social. This distinction corresponds roughly to that which exists between industrialization and urbanization. Then come distinctions based on successive stages of development: the pre-industrial period, the transition and the stage of completed industrialization.

There are some subjects which are not included in this outline. Among these the committee considers the situation of peasants who, evicted from their rural milieu for external reasons, group themselves in towns which are not yet sufficiently industrialized to be able to employ them, or that of an urban population of mineworkers when the mine is exhausted and abandoned.

CARNEGIE ENDOWMENT FOR INTERNATIONAL PEACE

European Centre

PRIZES IN INTERNATIONAL ORGANIZATION

The Carnegie Endowment for International Peace, in order to encourage research by Europeans into problems of international organization, to help young scholars to have interesting works in this field published, and to make generally available studies which might not otherwise see the light of day, announces an international competition.

The prizes will be awarded annually for a period of five years, beginning in 1955.

Regulations

1. *Subject.* The contributions may deal, on the basis of a serious analysis of experience with any aspect of the activity of international organizations. They must consist neither of abstract speculations regarding the nature and utility of international organizations, nor of mere descriptions of the functioning of institutions. For the purpose of this competition, the term 'international organization' will be understood to mean general or regional intergovernmental agencies.

2. *Closing date.* Entries must be received not later than 1 July 1955, in order to be eligible for the prizes offered in 1955.

3. *Eligibility.* Inasmuch as the purpose of the prizes is to encourage research by persons who have not yet had an opportunity to establish a reputation, the competition is open only to persons who have published at most one book in the fields of history, law and the social sciences. In order further to equalize the conditions of competition, two parallel series of awards will be established, the first for manuscripts and the second for printed books.

In order to be eligible for the first section of the competition, a person must not be the author of any published book in the fields indicated in the preceding paragraph. In determining eligibility for this series of awards, a doctoral dissertation reproduced in not more than 500 copies will not be counted as a published book. However, the entry itself must not have been reproduced for sale, except in the form of microfilm.

The second series of awards will be conferred upon published works which constitute in each case the first volume by the author in question in the fields indicated above. In this section of the contest, a maximum of two doctoral dissertations, whatever the number of copies distributed, will not be counted as published books. Needless to say, dissertations will be accepted as entries if they fulfill the conditions of contest.

Contestants in either category must also satisfy the following additional conditions:

(a) *Nationality*—Competitors must be nationals of the United Kingdom, Eire, or one of the countries of Continental Europe, or have resided in one or more of those countries for at least 10 years, as of 1 July 1955;

(b) *Age*—Contestants must not have passed their fortieth birthday on 1 July 1955.

4. *Language.* Entries may be written in the English, French, Italian or German language.

5. *Form of submission.* Entries in the manuscript section of the contest must be typewritten, double-spaced, on one side of the page only. Carbon copies are acceptable provided they are clearly legible. Published works shall be submitted in the form of the printed volume. In either case, five copies are required.

6. *Length.* It is expected that studies will be of the order of 90,000 words. Shorter entries are acceptable; primary emphasis in judging will be placed on content rather than on length. Entries of over 120,000 words will not be accepted in the manuscript section of the contest; published works should not exceed 350 printed pages.

7. *Judging.* Entries will be judged by a committee of five specialists in the field of international relations, including three Europeans, one North American, and one member rom another continent.

8. *Form of the awards.* (a) The Carnegie prize in the manuscript section of the contest will comprise a cash award of $500 and publication of the winning entry at the Endowment's expense, in an edition of at least 2,000 copies;

(b) The Carnegie prize in the book section will comprise a cash award of $1,500.

(c) One honorable mention of $250 will be awarded in each category.

(d) Should the judges decide that no entry in either or both categories is worthy of the Carnegie prize, they may at their discretion make special awards or increase the number of honorable mentions.

9. *Disqualifying clause.* All present and former employees of the Carnegie Endowment are disqualified from participating in the competition.

Entries and all correspondence regarding the contest should be addressed to: Centre Européen de la Dotation Carnegie, Route de Ferney 172, Grand-Saconnex, Geneva, Switzerland.

A SURVEY OF CURRENT RESEARCH ON THE MIDDLE EAST

The Middle East Institute, a private organization in Washington, D.C., is preparing for publication an annual Survey of Current Research on the Middle East. The purpose of this survey is to provide scholars and educational institutions with information on what research has recently been completed or is now being undertaken in the field.

Definition of research: (a) accumulation of original data; (b) classification of original data; (c) interpretation of data previously accumulated; (d) reinterpretation of data previously studied; (e) translation, bibliography, vocabulary, etc., with annotation.

Geographical limits: the Arab countries, Israel, Afghanistan, Iran, Turkey, North Africa, the Sudan, Ethiopia and Eritrea.

Disciplinary limits: emphasis on the social sciences, but including all related aspects of the humanities and natural sciences.

Chronological limits: none (ancient, medieval, and modern).

All those who are currently engaged in research on the Middle East, or have completed such research since 1 October 1954, are urged to submit the following information: name, address, topic of investigation, sponsoring organization (if any), date of completion or estimated date if still in progress, and pertinent comments on the nature of the research, sources being used, and method of approach.

Please address correspondence to: Survey of Research, The Middle East Institute, 1761 N. Street, N.W., Washington 6, D.C.

BOOKS RECEIVED

ALMOND, Gabriel A., with the co-operation of H. E. KRUGMAN, E. LEWIN, H. WRIGGINS. *The Appeals of Communism.* Foreword by F. S. Dunn. Princeton University Press, Princeton, New Jersey, 1954, xxii + 415 p.

Becas para Latinoamericanos en los Estados Unidos, Washington, Departamento de Asuntos Culturales, Union Panamericana, 1954, 95 p.

CAMPBELL, Angus, GURIN, Gerald, MILLER, Warren E., with the assistance of S. EBERHARDT and Robert A. McWILLIAMS. *The Voter Decides*, Evanston, Illinois, Row, Peterson and Company, 1954, viii + 242 p.

DAVAL, R., and GUILBAUD, G. T. *La Méthode Statistique.* Part I: Statistique à un seul caractère; section I: Statistique descriptive, et section II: Distributions binomiales. Paris, Presses Universitaires de France, 1954, 100 p.

ECHANOVE TRUJILLO, Carlos A. *La Sociología en Hispanoamérica*, Havana, Impreso en la Imprenta Universitaria, 1953, 175 p.

FALL, Bernard B. *The Viet-Minh Regime, Government and Administration in the Democratic Republic of Vietnam.* With a foreword by Lauriston Sharp. Data Paper: Number 14, South-East Asia Programme, Department of Far Eastern Studies, Cornell University, Ithaca, New York. Issued jointly with the Institute of Pacific Relations, 1954, x + 143 p.

Fünfster und Sechster Bericht der Deutschen Bundesregierung über die Fortführung der amerikanischen Wirtschaftshilfe (MSA/FOA), Bonn, Erstattet vom Bundesminister für Wirtschaftliche Zusammenarbeit, 1954, 122 p.

HAZLEWOOD, Arthur, *The Economics of 'Under-developed' Areas.* An annotated reading list of books, articles and official publications. Published for the Institute of Colonial Studies, London, Oxford University Press, 1954, xii + 89 p.

LANGE, Chr. W., and SCHOU, August. *Histoire de l'internationalisme*. vol. II: De la Paix de Westphalie jusqu'au Congrès de Vienne (1815). Published by the Norwegian Nobel Institute, Oslo, H. Aschehoug & Co. (W. Niggaard), 1954, xii + 482 p.

LANGROD, Georges, *Science et enseignement de l'administration publique aux États-Unis (Cahiers de la fondation nationale des sciences politiques)*, Paris, Librairie Armand Colin, 1954, 185 p.

LEWIS, Hilda. *Deprived Children, The Mersham Experiment, A Social and Clinical Study*. With a foreword by Sir Arthur Ellis and C. P. Blacker. Published for the Nuffield Foundation, London, New York, Toronto, Oxford University Press, 1954, xviii + 163 p.

MANCINI, Arturo. *Il Collettivismo nella Storia e nella Dottrina*, Milan, Giuseppe Intelisano, 1954, 242 p.

Médecins, Dentistes et Pharmaciens dans la Province de Liège. Contribution à l'Étude des Débouchés Professionnels. Travaux du Séminaire de Sociologie de la Faculté de Droit de Liège, IV. With a foreword by R. Clémens. Liège, Imprimerie H. Vaillant-Carmanne S.A., 1954, 97 p.

NESIAH, K. *Social Studies in the School*, Madras, Oxford University Press, 1954, viii + 124 p.

PERPINA, Roman. *Corologia, Teoria estructural y estructurante de la población de España (1900-1950)*, Madrid, Consejo Superior de Investigaciones Cientificas, Instituto de Economia 'Sancho de Moncada', 1954, 210 p.

RAO, Venkata V. *The Prime Minister*. With a foreword by M. Venkatarangiah. Bombay, Vora & Co. (Publishers) Ltd., 1954, 82 p.

SAPIN, Burton, SNYDER, Richard C., and BRUCK, H. W. *An Appropriate Role for the Military in American Foreign Policy-Making: A Research Note (Foreign Policy Analysis Series*, no 4.*)*, Organizational Behavior Section, Princeton University, 1954, 64 p.

SCHREURS, André. *Contribution aux études d'économie régionale en Wallonie. Problèmes de méthode* (Reprinted from the *Revue des Sciences Économiques*), Liège, 1954, 42 p.

SOLA CAÑIZARES, Felipe de. *Iniciación al Derecho Comparado*. With an introduction by René David. Barcelona, Consejo Superior de Investigaciones Cientificas, Instituto de Derecho Comparado, 1954, 330 p.

STERN, Erich. *Lebenskonflikte als Krankheitsursachen*, Zürich, Rascher Verlag Zürich, 1952, 360 p.

—. *Experimentelle Persönlichkeitsanalyse nach dem Murray-Test*, Zürich, Rascher Verlag Zürich, 1952, 210 p.

TUNC, André, and TUNC, Suzanne. *Le système constitutionnel des États-Unis d'Amérique*, vol. II : Le système constitutionnel actuel. With an introduction by René David. Paris, Éditions Domat Montchrétien, 1954, 542 p.

The System of Industrial Relations in Great Britain, Its History, Law and Institutions. Edited by Allan Flanders and M. A. Clegg. Oxford, Basil Blackwell, 1954, viii + 380 p.

WIESE, Leopold von. *Soziologie, Geschichte und Hauptprobleme*. 5th ed., Berlin, Walter de Gruyter & Co., 1954, 160 p.

Zeitlose Dokumente der Seele. H. Jacobsohn, 'Das Gespräch eines Lebensmüden mit Seinem Ba'; M.-L. von Franz, 'Der Traum des Descartes'; S. Hurwitz, 'Archetypische Motive in der Chassidischen Mystik'. Zürich, Rascher Verlag Zürich, 1952, 212 p.

American Psychological Association

PUBLICATIONS

AMERICAN PSYCHOLOGIST

Editor: FILLMORE H. SANFORD, *American Psychological Association.* Contains all official papers of the Association and articles concerning psychology as a profession; monthly.

Subscription: $8.00 (Foreign $8.50). Single copies, $1.00.

JOURNAL OF ABNORMAL AND SOCIAL PSYCHOLOGY

Editor: J. McV. HUNT, *University of Illinois.* Contains original contributions in the field of abnormal and social psychology, reviews, and case reports; bimonthly, two volumes per year.

Subscription: $10.50 for 2 vols (Foreign $11.00). Single copies, $2.00.

JOURNAL OF APPLIED PSYCHOLOGY

Editor: JOHN G. DARLEY, *University of Minnesota.* Contains material covering applications of psychology to business, industry, and education, and book reviews; bimonthly.

Subscription: $7.00 (Foreign $7.50). Single copies, $1.50.

JOURNAL OF COMPARATIVE AND PHYSIOLOGICAL PSYCHOLOGY

Editor: HARRY F. HARLOW, *University of Wisconsin.* Contains original contributions in the field of comparative and physiological psychology; bimonthly.

Subscription: $8.00 (Foreign $8.50). Single copies, $1.50.

JOURNAL OF CONSULTING PSYCHOLOGY

Editor: LAURANCE F. SHAFFER, *Teachers College, Columbia University.* Contains research relevant to clinical psychology-psychological diagnosis, psychotherapy, personality, and psychopathology; bimonthly.

Subscription: $7.00 (Foreign $7.50). Single copies, $1.50.

JOURNAL OF EXPERIMENTAL PSYCHOLOGY

Editor: ARTHUR W. MELTON, *AF Personnel and Training Research Center Lackland Air Force Base, San Antonio, Texas.* Contains original contributions of an experimental character; monthly, two volumes per year.

Subscription: $15.00 for 2 vols. (Foreign $15.50). Single copies, $1.50.

PSYCHOLOGICAL ABSTRACTS

Editor: C. M. LOUTTIT, *Wayne University.* Contains noncritical abstracts of the world's literature in psychology and related subjects; bimonthly.

Subscription: $8.00 (Foreign $8.50). Single copies, $2.00.

PSYCHOLOGICAL BULLETIN

Editor: WAYNE DENNIS, *Brooklyn College.* Contains evaluative reviews of research literature, discussions of research methodology in psychology, and book reviews; bimonthly

Subscription: $8.00 (Foreign $8.50). Single copies, $1.50.

PSYCHOLOGICAL MONOGRAPHS: GENERAL AND APPLIED

Editor: HERBERT S. CONRAD, *U.S. Office of Education, Washington, D.C.* Contains longer researches and laboratory studies which appear as units; published at irregular intervals, about 12 numbers per year.

Subscription: $7.00 per volume (Foreign $7.50). Single copies, price varies according to size.

PSYCHOLOGICAL REVIEW

Editor: THEODORE M. NEWCOMB, *University of Michigan.*
Contains original contributions of a theoretical nature; bimonthly.

Subscription: $6.50 (Foreign $7.00). Single copies, $1.50.

Order from

AMERICAN PSYCHOLOGICAL ASSOCIATION

1333 Sixteenth Street N.W., Washington 6, D.C., U.S.A.

LA REVUE ADMINISTRATIVE

BIMONTHLY REVIEW
OF MODERN ADMINISTRATION

6 issues a year, approximately 100-130 pages, 21 × 27 cm.
France: 2,200 fr.
Other countries: 2,700 fr.

Bureau 203, Bourse de Commerce, Paris-1er
Telephone: CEN. 23-90. C.C.P. Paris 5450-16

Specimen copy on request

ECONOMICA

PUBLISHED QUARTERLY

ECONOMICA is published quarterly by the London School of Economics and Political Science, in February, May, August and November, and is devoted to research in the fields of economics, economic history and statistics.

34TH YEAR: NEW SERIES, VOL. XXI, NO. 84: NOVEMBER, 1954

Economics of Dependence (1952-82)	F. W. PAISH and A. T. PEACOCK
Consistency and Consolidation in the Theory of Interest	RALPH TURVEY
Industrial Productivity Growth in Europe and in the U.S.	A. MADDISON
The Origin of Ricardo's Theory of Profits	G. S. L. TUCKER
Non-Traded Goods and International Factor Price Equalisation	E.. VICTOR MORGAN and G. L. REES
Book Reviews	
Books received	

The price of ECONOMICA (New Series) is 8s.6d. a number, or £1.5s. per annum, post free. Copies may be obtained on order from the Publications Department of the London School of Economics, Houghton Street, Aldwych, London, W.C.2, to which address all subscriptions and business communications should be sent.

HOMMES et MONDES

LA GRANDE REVUE FRANÇAISE D'ACTUALITÉ MONDIALE

MONTHLY REVIEW OF WORLD EVENTS

Literature — Science — History
Economics — Art — Politics

SUBSCRIPTION RATES:

France	1 yr.	1,950 fr.
	6 months	975 fr.
Other countries	1 yr.	2,500 fr.
	6 months	1,300 fr.

11 BIS, AVENUE KLÉBER, PARIS-16e — C.C.P. 5462-56

SOCIAL RESEARCH

An international quarterly, founded in 1934, published by the Graduate Faculty of Political and Social Science and the Institute of World Affairs of the New School for Social Research, New York

Contents for Winter 1954 (Volume 21, Number 4).

Congressional Investigating Committees	Alfred JUNZ
The Process of Balanced Economic Growth	Loreto M. DOMINGUEZ and Harold PILVIN
Rule by Majority or by Principles	Nathan ROTENSTREICH
The Authority of the Past—Sickness and Society in Freud's Thought	Philip RIEFF
Recent Labor Political Action in Western Europe	David J. SAPOSS
The Sociological Study of Sectarianism	Peter L. BERGER
Book Reviews	

Table of Contents and Indexes for Volume 21

Published in Spring, Summer, Autumn and Winter

Subscription $5 a year, Canadian and foreign $5.50; Single copies $1.50

66 WEST 12 STREET, NEW YORK 11, N.Y.

INTERNATIONAL AFRICAN INSTITUTE

AFRICA

Contains original articles on African ethnology, linguistics, social organization, notes on current researches, book reviews and a classified bibliography of current publications concerned with African questions.

Annual subscription:
35s., 1,720 fr., $5.25

AFRICAN ABSTRACTS
Bulletin Analytique Africaniste

Contains abstracts of current periodical literature concerned with African linguistic and sociological studies. Published in English and French.

Annual subscription
30s., 1,480 fr., $4.50

These quarterly publications may be ordered from the Secretary, International African Institute, 10-11 Fetter Lane, London, E.C.4, to whom enquiries about other publications and activities of the Institute should be addressed.

You will gain a better understanding of many of today's most urgent issues—

- the problems of negotiating for peace in an atmosphere of increasing world tension
- a number of the factors which transformed war-time allies into peace-time rivals

from reading the case-study of the successful conclusion of the peace treaties with Italy, Bulgaria, Hungary, Rumania and Finland in

EUROPEAN PEACE TREATIES... ...AFTER WORLD WAR II

edited by Amelia Leiss in cooperation with Raymond Dennett $4.75

WORLD PEACE FOUNDATION
40 Mt. Vernon Street, BOSTON 8, Mass.

BULLETIN FOR INTERNATIONAL FISCAL DOCUMENTATION

Bi-monthly periodical published by the International Bureau of Fiscal Documentation. HERENGRACHT 196, AMSTERDAM, NETHERLANDS.

The object of the Bulletin is to provide information on the laws relating to taxation in various countries and on international and comparative fiscal law.

The following subjects have been or will be dealt with:

1. Taxation in Federal States.
2. The legal provisions relating to the computation of taxable profits of industrial and commercial enterprises.
3. Fiscal evasion, its causes and legal provisions to avoid it.
4. The taxation of life insurance, pensions, (life) annuities, etc.

There are also included

Information on Statute and Case Law together with any official comments thereon.

Review of books and articles dealing with taxation matters.

A dictionary in four to six languages of technical fiscal terms.

Supplements containing, *inter alia*, revues of double taxation conventions together with the text of the conventions.

PRICE { Flor. Holl. **19** a year without supplements / Flor. Holl. **26.50** a year with supplements } or equivalent in other currencies

JOURNAL OF WORLD HISTORY
CAHIERS D'HISTOIRE MONDIALE
CUADERNOS DE HISTORIA MUNDIAL

A Quarterly, issued by appointment of the International Commission for a History of the Scientific and Cultural Development of Mankind
by Professor LUCIEN FEBVRE, Membre de l'Institut.
Subscription to Volume II (July 1954-April 1955).
Fr.fr.2,100; £2.2.0; U.S.$6.

An outgrowth of the proposed *History of Mankind* is the publication of the new *Journal of World History*. International in scope and outlook, with articles in English, French or Spanish, the *Journal of World History* will serve as a means by which outstanding contributions to the *History of Mankind* will be submitted to public examination (and eventually criticism) prior to the appearance of the *History* itself. The contributions concerned will deal with all periods of history and all branches of historical research: political, social, economic.

Exclusive sole agent for U.S. subscriptions: STECHERT-HAFFNER, Inc., 31 East 10th Street, New York 3.
In other English-speaking countries subscriptions may be sent to any bookseller, to all Unesco Agencies, and to
BLACKWELL'S, Oxford; Wm. DAWSON, Macklin Street, London, W.C.2; 587 Mount Pleasant Road, Toronto 12.

World sole agent:
LIBRAIRIE DES MÉRIDIENS - 119, boulevard Saint-Germain, Paris-6e.
Unesco Book Coupons acceptable

RECENT ARTICLES OF CURRENT INTEREST

Journal of Central European Affairs

Contents-January 1955

German Eastward Expansion, Fact and Fiction: A Study in German Ottoman Trade Relations 1890-1914 . . . *M. L. Flaningam*

A Proposed Compromise over Danzig in 1939 ? . . . . . *Gerhard L. Weinberg*

Soviet Doctrine of Mare Clausum and Policies in Black and Baltic Seas. . *Kazimierz Grzybowski*

Eastern European Federation: A Study in the Conflicting National Aims and Plans of the Exile Groups. . . *Elizabeth Kridl Valkenier*

Communist Literature in Rumania . *Nicholas Timiras*

Notes and Correspondence Book Reviews

Recent Periodical Literature

Published quarterly at the University of Colorado, Boulder, Colorado

S. HARRISON THOMSON, EDITOR

Yearly Subscription: $5.00 Single Copies: $1.50
Postage outside U.S.: $ .25

THE LEADING MONTHLY ON ASIAN AFFAIRS

EASTERN WORLD

Keeps its readers abreast with the political, social, and economic developments in that area and aims at fostering a greater understanding between East and West. As a non-party, impartial forum for free discussion, its articles contain vital information on Asian affairs and mirror the leading opinions on all issues concerning that part of the world. Important controversial matters are ventilated in an independent manner and offer an invaluable source of information on that centre of world affairs. It is well illustrated and belongs to those few international publications which are essential to everyone who wishes to follow world events.

"... No student of Asian affairs can afford to miss this publication...."

THE TIMES

Yearly Subscription: £1.5.0 (post-free).

EASTERN WORLD, 45 DORSET ST., LONDON, W.1

FUNFTES HEFT/10. JAHRGANG 1954

POLITIK

Walter H. Johnston: Das Deutschlandbild der Briten/ *Pierre Viansson-Ponté:* Mendès-France und Deutschland / *Frederik H. Hartmann:* Sowjetrussland und das deutsche Problem

GESELLSCHAFT

Religiöse Soziologie — Aufgabe und Erfahrung : Umfragen in Frankreich, Belgien, Italien und Spanien

LITERATUR

Die Schönheit und das Absurde bei Camus / Mauriacs erster Priesterroman / Orwell und der Glaube an das Leben

Heft 5/54 2.— DM, Jahresabonnement (6 Heite) 9.— DM, für Studenten 6.— DM zuzüglich Porto. Verlangen Sie unverbindlich ein Probeheft.

ZEITSCHRIFT IM DIENST ÜBERNATIONALER ZUSAMMENARBEIT

DOKUMENTE

ZWEIMONATLICH IM DOKUMENTE-VERLAG OFFENBURG/BADEN

DER FILM IN EUROPA

SONDERHEFT DER DOKUMENTE

Aufsätze und Berichte von international anerkannten Fachleuten wie Lo Duca, Henri Agel, Theo Fürstenau, Björn Rasmussen, Charles Reinert, Jean-Louis Tallenay u. a. behandeln folgende Fragen:

— Kann der Film ein Kunstwerk sein
— Wie beeinflusst der Film den Menschen
— Dient der Film der Völkerverständigung
— Warum versagt die westdeutsche Filmproduktion künstlerisch
— Setzt die sowjetzonale DEFA die grosse deutsche Filmtradition fort
— Dreht Frankreich nur Spitzenfilme
— Gehört Hollywood der Vergangenheit an
— Nur Sadismus aus Südamerika
— Hat der Neo-Verismo seinen Höhepunkt überschritten

Statistiken, graphische Darstellungen, Regisseurbiographien und eine Übersicht über die wichtigste Filmliteratur in vier Sprachgebieten bieten wertvollstes Nachschlagematerial.

96 Seiten Text und 24 Seiten Kunstdruckfotos. Preis 3.— DM.

the journal of politics

A QUARTERLY JOURNAL DEVOTED TO THE STUDY OF POLITICAL SCIENCE IN AMERICA AND OVERSEAS

The *Journal of Politics*, now in its fourteenth year, is published four times a year with a total of *circa* 800 pages annually. It presents articles, both critical and interpretative, which emphasize the functional side of political science.
The *Journal of Politics* publishes materials drawn from the entire field of political science, both in America and in countries overseas. Its contributors include the leading scholars in the field such as George H. Sabine, Hans Kelsen, Francis W. Coker, Herman Finer, Edward S. Corwin, and many others. Their contributions cover the major areas of political science:

Political Theory - Public Law - Administration - Politics - International Law - American National and State Government - Comparative Government - Government and the Economy.

From time to time the *Journal of Politics* has set aside an entire issue for a symposium on a topic of current interest. The most recent in this series appeared in the August 1951 issue, containing eight articles by outstanding scholars and leading government officials on the topic *Resources and Policy: Current Issues in Conservation*. Other symposia were devoted to the British Labour Government 1945-1950, the American Presidency, the American South, and post-war governments of Europe and the Far East.

Annual Subscription $5.00 (Outside the Western hemisphere $5.50).
Published by the Southern Political Science Association in co-operation with the University of Florida.

EDITOR: Lee S. Greene, *University of Tennessee*, Knoxville 16, Tennessee.
ASSOCIATE EDITOR: Robert S. Avery, *University of Tennessee*, Knoxville 16, Tennessee.
MANAGING EDITOR: Manning J. Dauer, *University of Florida*, Gainesville, Florida.

Please address all subscription correspondence to the Managing Editor.

International Digest of Health Legislation

Separate Editions in English and French

The *International Digest of Health Legislation*, published quarterly by the World Health Organization, is the only periodical devoted solely to health legislation. Each number contains a selection of health laws and regulations from many countries. In addition, comparative studies of legislation on special subjects are published occasionally.

Subscription per volume of 4 numbers:	40/-	$6.90 Sw.Fr.25
Price per number:	12/-	$1.75 Sw.Fr. 7

COMPARATIVE STUDIES (Offprints)

NURSING	A survey of recent legislation (from Vol. 4, No. 4)		
	A comparative study of the laws governing the practice of nursing in more than 20 countries (35 pages)	2/-	$0.25 Sw.Fr. 1
LEPROSY	A survey of recent legislation (from Vol. 5, No. 1)		
	A comparative study of leprosy control laws in 35 countries (33 pages)	1/9	$0.25 Sw.Fr. 1
SMALLPOX VACCINATION	A survey of recent legislation (from Vol. 5, No. 2)		
	A comparative study of the laws governing smallpox vaccination in more than 50 countries (40 pages)	3/6	$0.50 Sw.Fr. 2
MIDWIVES	A survey of recent legislation (from Vol. 5, No. 3)		
	A comparative study of the laws governing the practice of midwifery in 30 countries	3/6	$0.50 Sw.Fr. 2

Orders may be sent through your usual bookseller or directly to:

SALES SECTION, WORLD HEALTH ORGANIZATION, *Palais des Nations, Geneva, Switzerland.*

Centre d'études de politique étrangère
54, rue de Varenne, Paris-7e

POLITIQUE ÉTRANGÈRE

La grande revue des questions internationales.
N° 5-6, novembre-décembre 1954

André ARMENGAUD — L'Europe, problème économique et social.

Paul CHAUVEAU — L'Europe et ses transports par air.

Édouard SABLIER — L'Égypte, propagande et réalités politiques.

Léo HAMON — Essai d'introduction à la politique turque.

Jo W. SAXE — L'étude sociologique des institutions européennes en Afrique.

Le numéro : 600 francs.

Abonnements : France et Union française : 1.800 francs.
Étranger : 2.250 francs.

Association of Principals of Technical Institutions (India)

Regd.
c/o Delhi Polytechnic, Lothian Road, Delhi-6, India
Established 1941

1. The Journal of the Association is published every three months, i.e. in May, August, November and February.
2. Annual subscription for the Journal is Rs. 6-8-0 (including postage). Price of single copy is Rs. 1-8-0.
3. The Journal is an organ of the Association and will mainly publish views and observations of its members on Technical Education and subjects allied to it. The Editorial Board also cordially welcomes articles of similar nature from non-members.
4. Articles should preferably be typed on one side of the paper. Photographs, diagrams, etc., should be sent along with the articles.
5. Books for the purpose of reviewing in the Journal may be sent to the Managing Editor.

REVISTA INTERAMERICANA DE BIBLIOGRAFIA

INTER-AMERICAN REVIEW OF BIBLIOGRAPHY

A scholarly triannual containing articles, book reviews, notes and selected bibliographies pertaining to Latin America. With a staff of collaborators in 42 nations and territories which provides news reports about authors, books, periodicals, publishers and libraries.

Published by the Division of Philosophy, Letters and Sciences, Department of Cultural Affairs, Pan American Union, Washington 6, D.C.

Subscription rates: $3.00 a year in the Americas and Spain;
$3.50 in all other countries.

IL POLITICO

RIVISTA DI SCIENZE POLITICHE

DIRETTA DA
BRUNO LEONI

DICEMBRE 1954

C. E. FERRI — Lo studio dell'azione umana : aspetto giuridico ed aspetto economico.
P. BISCARETTI DI RUFFIA — La monarchia nello stato moderno.
D. PHILIP — La democrazia pluralista svedese.

NOTE E DISCUSSIONI

— *La sociologia in Italia. Saggio bibliografico* - I (F. Barbano)
— *Sociologia e filosofia* (G. Nirchio)
— *Lo sviluppo dell'assolutismo* (G. Vestuti)

ATTIVITA' DELL'ISTITUTO

Congresso della Mont Pèlerin Society
Democrazia, socialismo e norma giuridica (di B. Leoni)
VII Convegno di studi di economia e politica industriale
Congresso internazionale sul problema delle aree arretrate

RECENSIONI

(*Sono recensiti libri di* : A. et S. Tunc, J. A. Schumpeter, M. L. Deveali, C. Lega, K. Marx, J. R. Hicks, I. Gannopolsky, P. G. Villalbi, A. Fanfani, E. L. Spears, B. Rivlin, C. Vasoli, A. C. Jemolo, R. Guardini, A. Ghisleri, etc.).

ANNO XIX N. 3

ANNUAL RATE : 2,500 LIRES
Send subscriptions and correspondence to:

ISTITUTO DI SCIENZE POLITICHE,
UNIVERSITA DI PAVIA (ITALIA)

THE AMERICAN ECONOMIC REVIEW

VOLUME XLIV — DECEMBER 1954

Articles

International Trade — The Soviet Bloc	EDWARD AMES
Exchange Rate Adjustments and Living Standards	W. L. SMITH
Optimal Advertising and Optimal Quality	ROBERT DORFMAN and P. O. STEINER
The International Sugar Agreement of 1953	B. C. SWERLING
Planning in Consumer Purchases—Durable Goods	ROBERT FERBER
Income Shares: Great Britain and the United States	A. M. CARTER

Review Articles

Full Employment—1954 Model .	P. J. STRAYER
Schumpeter's History of Economic Analysis	JACOB VINER

Reviews of Books, Titles of New Books, Periodicals, Notes

The AMERICAN ECONOMIC REVIEW, a quarterly, is the official publication of the American Economic Association and is sent to all members. The annual dues are $6. Address editorial communications to Dr. Bernard F. Haley, Editor, *American Economic Review*, Stanford University, Room 220, Stanford, California; for information concerning other publications and activities of the Association, communicate with the Secretary-Treasurer, Dr. James Washington Bell, American Economic Association, Northwestern University, Evanston, Illinois. Send for information booklet.

CHRISTIANISME SOCIAL

Sommaire du numéro 11-12
Nov.-Déc. 1954

FRANÇOIS MAURIAC : Le Christ aussi était un homme. — ANDRÉ VERMEIL : Catholiques et protestants. — ANDRÉ PHILIP : Les comités d'entreprise. — RAOUL CRESPIN : L'expérience économique Mendès-France. — Mme J.-P. VERNES : La production ouvrière « Castor ».

★

JACQUES BOIS : Europe, reconversion du vieux monde. — STUART R. SCHRAM : La coexistence selon M. R. Aron.

★

Notre vie quotidienne.

★

Chroniques.

SERGE RADINE : « Le Diable », de Papini. — Dr JEAN DE ROUGEMONT : Sur la limitation des naissances. — GÉRARD M. ABENSOUR : La jeunesse répond.

★

Notes et documents. Livres et revues.

Le numéro : 200 francs. L'abonnement : 1.100 francs.
52, rue de Londres, Paris-8e. *C. C. P. 6337-54 Paris.*

THE MIDDLE EAST JOURNAL

THE ONLY AMERICAN QUARTERLY EXCLUSIVELY DEVOTED TO DISCUSSION OF MIDDLE EAST TOPICS

Authoritative, objective, non-partisan, the JOURNAL keeps its readers abreast of developments in a detailed quarterly chronology, reviews the latest books and lists fully American and foreign periodical materials dealing with the area. It publishes significant documents and state papers, and highlights in its articles political, social and cultural trends in ALL countries of the Middle East.

ONE-YEAR SUBSCRIPTION $6 TWO YEARS $11

(Payable in U.S. dollars or Unesco book coupons)

THE MIDDLE EAST INSTITUTE

1761 N STREET, N.W. WASHINGTON, D.C.

SOCIETÀ EDITRICE IL MULINO

Francesco Compagna — Vittorio De Caprariis

Geografia delle elezioni Italiane dal 1946 al 1953

L. 300

Filosofia e Sociologia

Scritti di :

Abbagnano, Battaglia, Banfi, Brunello, Canestrari, Chiodi, Fassò, Galli, Govi, Le Blonde jr., Luporini, Manferdini, Massolo, Matteucci, Morpurgo-Tagliabue, Morra, Oggioni, Paci, Pastore, Palumbo, Pedrazzi, Rizzoli, Santucci, Semerari, Stefanini, Sturzo, Treves, Vedaldi, Zangheri.

L. 1.500

SOCIETÀ EDITRICE IL MULINO

Via Montebello, 8/b — BOLOGNA — Tel. 39-381 — C. C. P. 8/12926

Economia Internazionale

REVUE TRIMESTRIELLE

Vol. VII, nº 4 — Novembre 1954

E. LINDAHL, Il sistema economico keynesiano. — A. SERPIERI, La riforma agraria in Italia. — G. L. S. SHACKLE, The Complex Nature of Time as a Concept in Economics. — P. SYLOS-LABINI, Monopoli, ristagno economico e politica keynesiana. — S. C. TSIANG, The Economics of Foreign Exchange Retention Schemes. (II) Broken Cross Rates. — V. TRAVAGLINI, L'insegnamento delle discipline economiche nelle facoltà di economia e commercio. — MERCATOR, East-West Trade : Prospects and Limitations.

Bollettino Bibliografico ed Emerografico : revues des volumes reçus ; titres d'articles parus dans des périodiques récents ; sommaire d'articles parus dans des périodiques récents.

L'abonnement annuel à *Economia Internazionale* est de 5.000 lires. Adresser les demandes d'abonnement et la correspondance à la direction, Istituto di Economia Internazionale, via Garibaldi 4, Genova (Italia).

SOCIOLOGICAL ABSTRACTS

A quarterly periodical containing detailed abstracts from American and foreign sociological periodicals in the English language under a pragmatic classification, with journal, author and content indexes.

Vol. 1: Nov. 1952-Oct. 1953.
Vol. 2: Jan. 1954-Oct. 1954 are available.
Vol. 3: Jan. 1955-Oct. 1955 to be published.

Annual subscriptions are: U.S.A., $3.50 individual, $4.50 libraries and institutions; $5 foreign subscriptions except Canada and Mexico.
Address all communications and subscriptions to:

The Editor, SOCIOLOGICAL ABSTRACTS
218 East 12th Street, New York 3, N.Y., U.S.A.

CRITIQUE

revue générale des publications françaises et étrangères

Directeur : GEORGES BATAILLE

« CRITIQUE » publie des études, rédigées par les meilleurs spécialistes, sur les plus importants ouvrages traitant des questions suivantes : littérature, beaux-arts, philosophie, religions, histoire, théorie politique, sciences et sciences sociales.

SOMMAIRE DU N° 91
DÉCEMBRE 1954

EDMOND VERMEIL	Littérature et culture en Europe.
GEORGES CATTAUI	Proust après trente ans (III).
HENRI NIEL	Psychanalyse et religion d'après C. G. Jung.
RAYMOND BARRE	Développement économique et biologie sociale.
WALDEMAR TARR	L'arbre généalogique de l'espèce humaine.

NOTES

Notes par : Jacques Brenner, Claude Delmas, Louis Grodecki, Paul Jaffard, Hubert Juin, Louis Renou.

TABLES DU TOME X (année 1954, nos 80 à 91).

Prix de vente au numéro : 180 francs

Tarif d'abonnement	*6 mois*	*1 an*
France et Union française	1.000 fr.	1.900 fr.
Étranger	1.200 fr.	2.300 fr.

LES ÉDITIONS DE MINUIT
7, rue Bernard-Palissy, PARIS-6e
LITtré 17-16, C.C.P. 180.43

La Revista de Derecho Jurisprudencia y Administración (Montevideo, Uruguay)

Director: EDUARDO J. COUTURE

DOCTRINA
JURISPRUDENCIA
LEGISLACIÓN
CASOS PRÁCTICOS
BIBLIOGRAFÍA

Suscripción: en el Uruguay, $15 m/u; al exterior, US $7.50

Correspondencia a: Dr. Eduardo J. Couture, bulevar España 2122, Montevideo, Uruguay.

ORGANIZATION OF AMERICAN STATES

GENERAL SECRETARIAT

PUBLICATIONS IN THE SOCIAL SCIENCES

CIENCIAS SOCIALES. Bi-monthly, 48-page bulletin featuring original articles, abstracts, critical reviews, bibliography and news in the field of anthropology, sociology, human geography, and social psychology. Per copy U.S.$0.15.

MONOGRAPH SERIES

La Sociología en los Estados Unidos, 1900-1950. (1953, 85 p.) U.S.$0.30.

TECHNICAL MANUALS

Guía para la Clasificación de los Datos Culturales. (1954, 284 p.) U.S.$1. Spanish translation of the "Outline of Cultural Materials" by George P. Murdock, pertaining to the Human Relations Area Files.

DIRECTORIES

Guía de Instituciones y Sociedades en el Campo de las Ciencias Sociales:
Part I: United States (1953, revised edition, 77 p.) U.S.$0.20.
Part II: Latin America (1954, revised edition, 177 p.) U.S.$0.30.

General catalogue of publications in English, French, Spanish and Portuguese dealing with Latin American affairs available upon request from:

PAN AMERICAN UNION General Secretariat
Organization of American States—Washington 6, D.C., U.S.A.

ÉDITIONS DU MONDE NOUVEAU

185, rue de la Pompe, Paris-16e. — C. C. P. Paris 56.82-70.

MONDE NOUVEAU PARU

10e ANNÉE N° 80-81

DE L'ALLEMAGNE

SOMMAIRE :

André François-Poncet	France, Allemagne, ces voisins
Robert Schuman	Espoirs et déboires de l'Europe
Bertrand de Jouvenel	Les rapports franco-allemands
Raymond Aron	La coopération nécessaire : en quête d'une méthode
Bernard von Brentano	Héros et actions d'éclat (*récit sarcastique*)
Adolf Sonnenhol	Importation-exportation
Klaus-Ulrich Goksch	Le commerce avec la France
F. O. Boltze	La reconstruction de Francfort
Kurth Ihlefeld	Un parrain anglais de la foire de Hanovre
Alfred Lajusan	Revision des manuels scolaires
H. J. von Moltke	Nazisme et résistance
Joseph Perrin	Une ascèse du souvenir
Marcel Beaufils	Deux humanismes complémentaires
M. von Bethmann	Voisins en Europe
Franz Thierfelder	Mon image de la France
Georg Romeiser	La mort sur l'autoroute (*nouvelle*)
Michel Carrouges	Melmoth et les hommes illustrés
Aimé Patri	En relisant *l'Esthétique* de Hegel
Armand Guibert	Libre-échange poétique
René Huyghe	L'art sacré

Son et lumière à Vincennes, par Gilbert Ganne

Les expositions, par Michel Georges-Michel

Les disques, les livres

REVUE MENSUELLE INTERNATIONALE

Abonnements : France et Union française : 1.600 fr. Étranger : 1.900 fr.

Ce numéro double de 272 pages : 350 fr.

REVISTA DE LA FACULTAD DE DERECHO DE MÉXICO

Órgano de la Facultad de Derecho de la Universidad Nacional Autónoma de México

Se publica trimestralmente, en números de 250 páginas.
Secciones que comprende:
DOCTRINA — RESEÑAS BIBLIOGRÁFICAS — LEGISLACIÓN (federal y local) — JURISPRUDENCIA — INFORMACIÓN JURÍDICA EXTRANJERA — INFORMACIÓN GENERAL.
Suscripciones: « Revista de la Facultad de Derecho de México», Ciudad Universitaria, Torre de Humanidades, 3.er piso, villa A. Obregón 20, MÉXICO D.F.
Precio de la suscripción anual: $5.

REVISTA MEXICANA DE SOCIOLOGÍA

Publicada por el Instituto de Investigaciones Sociales de la Universidad Nacional Autónoma de México

Se publica un ejemplar cada cuatro meses; contiene colaboraciones inéditas de los más prestigiados sociólogos latinoamericanos, norteamericanos y europeos

Precio del ejemplar suelto: $ .50;
Precio de la suscripción anual: $1.50

Instituto de Investigaciones Sociales de la Universidad Nacional Autónoma de México, Ciudad Universitaria, Edificio de Humanidades, 15.º piso, villa A. Obregón 20, México D. F.

Synthèses

Revue européenne
paraissant à Bruxelles
sous la direction de Maurice LAMBILLIOTTE

Sommaire du numéro 103 de Décembre 1954

Éditorial : LA RÉVOLUTION INTÉRIEURE, par Maurice LAMBILLIOTTE
Grande-Bretagne, Commonwealth et Europe unie, par GOEAU-BRISSONNIÈRE
Introduction à la philosophie de l'art, par Léon BOPP
Le manichéisme, un rival du christianisme, par E. ROCHEDIEU
Le journal de l'analogiste, par Roger BODART
Le moulin de Paul Arene, par Jean PROAL
V. Hugo. Carnets intimes, 1870-1871, par Marie-Louise GOFFIN
Paris, spectacle permanent, par JEAN-LÉO

Chroniques

Chronique littéraire, par Nelly CORMEAU
Chronique des lettres anglo-saxonnes, par Jacques DUESBERG
Chronique économique, par Raymond LARCIER
Chronique des revues, par Christiane THYS-SERVAIS
Synthèse de la presse étrangère, par DROGMAN

Secrétaire de rédaction :
Christiane THYS-SERVAIS,
230, rue J.-Fr.-De Becker, Bruxelles

Sur demande, un ancien numéro sera envoyé gracieusement à titre de spécimen.

THE AUSTRALIAN INSTITUTE OF POLITICAL SCIENCE

The Australian Institute of Political Science, an educational and research organization, was founded in 1932 to encourage and assist in the scientific approach to the political, economic and social problems of Australia. This it does by means of annual SUMMER SCHOOLS and WINTER FORUMS and by the publication of THE AUSTRALIAN QUARTERLY, in which many aspects of Australian life and its present-day problems are dealt with by qualified speakers and writers. Special courses of lectures in local centres are arranged upon request.
ASSOCIATE MEMBERSHIP of the Institute (including copy of THE AUSTRALIAN QUARTERLY) is open to all at £1 per annum.

PUBLICATIONS OF THE INSTITUTE
PROCEEDINGS OF SUMMER AND WINTER SCHOOLS

NATIONAL ECONOMIC PLANNING (1934)
EDUCATING A DEMOCRACY (1936)
AUSTRALIA'S FOREIGN POLICY (1938)
AUSTRALIA'S POST-WAR ECONOMY (1945)
A WHITE AUSTRALIA? (1947)
THE HOUSING PROBLEM IN AUSTRALIA (1947)
FEDERALISM IN AUSTRALIA (1949)
AUSTRALIAN PRODUCTION AT THE CROSSROADS (1952)
THE AUSTRALIAN POLITICAL PARTY SYSTEM (1953)
TAXATION POLICY (1953)
NORTHERN AUSTRALIA—TASK FOR A NATION (1954)

Rural Bank Building, 34 Elizabeth Street, Sydney. Tel.: BW 9544

L'année politique et économique

publie des études de haute tenue scientifique sur les grands problèmes de politique française et de politique internationale.

Indépendante de tous groupements politiques ou autres, *L'année politique et économique* a pour seule ambition de dire ce qu'elle croit vrai.

Directeur : BERNARD LAVERGNE, *professeur à la Faculté de droit de Paris.*

La revue paraît tous les deux mois.

ABONNEMENT ANNUEL : FRANCE et UNION FRANÇAISE : 1.100 francs.
ÉTRANGER : 1.300 francs.

CHAQUE FASCICULE : 300 francs.
On envoie sur demande un spécimen gratuit.

ADMINISTRATION : 19, QUAI DE BOURBON, PARIS-4e.

Vous vous intéressez
aux problèmes des relations internationales ?
Vous ne pouvez, dès lors,
manquer de lire régulièrement

CHRONIQUE DE POLITIQUE ÉTRANGÈRE

Revue bimestrielle

Des numéros spécimens sont envoyés sur demande

CONDITIONS D'ABONNEMENT :

Belgique et grand-duché de Luxembourg : 250 fr. belges, à verser à notre C. C. P. 289.33. Etranger : 280 fr. belges, à verser à notre compte 49.441 près la Banque de la Société générale de Belgique, 3, Montagne du Parc, Bruxelles. Vente à l'exemplaire : 50 fr. belges.

La *Chronique de politique étrangère* a pour but de décrire d'une manière objective les grands événements internationaux et de mettre à la disposition de ses lecteurs les principaux textes qui doivent leur permettre d'étudier et de juger la situation internationale.

YEARBOOK OF INTERNATIONAL ORGANIZATIONS

Édition 1954-55

1.200 organisations internationales : les Nations Unies et les institutions spécialisées, la Communauté européenne du charbon et de l'acier, une centaine d'organismes intergouvernementaux, un millier d'organisations internationales non gouvernementales.

Index analytique, alphabétique, géographique, en français et en anglais, des abréviations.

Tables des relations consultatives des pays avec l'O.N.U.

1.200 pages — $10

Publié en collaboration avec le Secrétariat des Nations Unies par l'Union des associations internationales, Palais d'Egmont, Bruxelles.

PHYLON

The Atlanta University Review of Race and Culture

INVITES YOU to join our expanding group of regular readers of the only publication devoted exclusively to trends and events in racial and cultural relations.

PHYLON features distinguished writers in:

Topical and timely analyses
Professional and scientific papers
Personality profiles
Short stories and poetry
Reviews of current books and
AN ANNUAL SPECIAL ISSUE

PHYLON rates are as follows:

$2 per year; a two-year or two subscriptions for $3.50.

Foreign subscriptions: $2.50 a year; single copies, $1. Subscriptions for Sterling areas including Great Britain, Africa, Asia, Australia and the West Indies: 15s. a year; single copies: 3s. 6d. Address: Intereps, Ltd., 15 New Row, St. Martin's Lane, London, W.C.2, England.

PHYLON, ATLANTA UNIVERSITY, ATLANTA 3, GEORGIA

INDIA AND HER NEIGHBOURS

The Indian Council of World Affairs has planned a series of books entitled INDIA AND HER NEIGHBOURS. The aim of the series is to present a concise account of recent developments in the political, economic and cultural relations between India and her neighbouring countries.

First three volumes in the series published

INDIA AND MALAYA, by N. Raghavan
Rs. 2/12/-

INDIA AND CEYLON, by C. Ramachandra Rao
Rs. 2/12/-

INDIA AND BURMA, by W. S. Desai
Rs. 2/8/-

Distributors:
ORIENT LONGMANS LIMITED
Bombay — Calcutta — Madras — New Delhi — Vijayawada

DIOGÈNE

Réd. en chef : ROGER CAILLOIS

REVUE INTERNATIONALE DES SCIENCES HUMAINES

SOMMAIRE DU N° 9

RAFFAELE PETTAZZONI	L'esprit du paganisme.
DARYLL FORDE	Les annales de l'humanité.
BERTRAND DE JOUVENEL	L'entraîneur et l'ajusteur.
OTHMAR ANDERLE	Le bouleversement de l'histoire.
FRANÇOIS LE LIONNAIS	Bases et lignes de force de la cybernétique.

CHRONIQUES

MIRCEA ELIADE, Mythologie et histoire des religions.
RENÉ ROUX, Puritanisme et démocratie.

ÉTUDES, NOTES ET COMPTES RENDUS PAR

LOUIS BAUDIN, GENNARO SASSO, A. W. MACDONALD.

Rédaction et administration: 19, avenue Kléber, Paris-16e (Tél. : Kléber 52-00).
Revue trimestrielle paraissant en six langues : allemand, anglais, arabe, espagnol, français, italien.
L'édition française est publiée par la librairie Gallimard, 5, rue Sébastien-Bottin, Paris-7e.
Les abonnements sont souscrits auprès de cette maison (C. C. P. 169.33 Paris).
Prix de vente au numéro : 200 fr. Tarif d'abonnement : France 700 fr.; étranger 875 fr.

THE INTERNATIONAL INSTITUTE OF DIFFERING CIVILIZATIONS

11, boulevard de Waterloo, Brussels, Belgium

Editors of

CIVILISATIONS. A quarterly bi-lingual review (English-French), 160 pages per issue, devoted to the problems raised by the interaction of differing civilizations and the introduction of modern techniques into particular areas. No. 3 of 1954 contains 7 articles on *Prevention of waste of natural resources, Documents,* annual *Social Surveys* of the British Empire, the French Union, the Spanish Dependencies, the Belgian Congo, South Africa, India and Ceylon.

Annual subscription: 250 Belgian francs; U.S. $5.00; 36s.

RURAL DEVELOPMENT IN TROPICAL AND SUB-TROPICAL COUNTRIES. Proceedings of the 28th Session of Incidi, September 1953 (out of point). One octavo volume, 404 p. Price: 275 Belgian francs; U.S. $5.50; £2.0.0.

THE PULL EXERTED BY URBAN CENTRES IN COUNTRIES IN COURSE OF INDUSTRIALIZATION. Proceedings of the 27th Session of Incidi, June 1952. One octavo volume, 662 p. Price: 350 Belgian francs; U.S. $7.00; £2.10.0.

our journals

THE MARCH OF INDIA

Bi-monthly, aims at interpreting India's thought and culture and social, economic and scientific advancement to the English-speaking world. Profusely illustrated and printed on real art paper.

Price per copy 3s. 6d. or 55 cents
Annual subscription 21s. or $3

KASHMIR

Monthly devoted to the life and problems of Kashmir. Illustrated with paintings, photographs and sketches.

Price per copy 9d. or 10 cents
Annual subscription 9s. or $1

KURUKSHETRA

Official organ of the Community Projects Administration, this monthly portrays the rural welfare and community development in India.

Price per copy 8d. or 10 cents
Annual subscription 7s. or $1

A.I.R. SELECTIONS

Quarterly containing the cream of talks broadcast by the All India Radio

Price per copy 1s. 6d. or 20 cents
Annual subscription: 5s. or 75 cents

THE PUBLICATIONS DIVISION, OLD SECRETARIAT
DELHI-8

Vocational Guidance in France

Studies and Reports, New Series, No. 39

In recent years there has been a very rapid development of vocational guidance services in France. State subsidies to vocational guidance centres have risen from 367,500 francs in 1934 to 600 million francs in 1952. The present study gives an account of the organization and methods of work of the different services.

CONTENTS

PART I. ADMINISTRATIVE ORGANIZATION OF VOCATIONAL GUIDANCE

I. GUIDANCE SERVICES FOR YOUNG PERSONS.

II. GUIDANCE SERVICES FOR ADULTS.

III. AUXILIARY SERVICES. The University Educational and Occupational Statistics and Documentation Office, the school psychology services, the observation centres of the reformatory department, guidance services for disabled young persons, the National Labour Research and Vocational Guidance Institute, the Vocational Psychology Study and Research Centre, the Vocational Supervisors' Training Institute, the National Centre for Scientific Research, the Laboratory for Applied Psychology and the Laboratory for Child Psychology, selection and guidance services attached to state technical undertakings, guidance or selection centres administered by occupational associations, special services for North Africans, special services for the guidance and placement of immigrants and refugees.

PART II. METHODS OF VOCATIONAL GUIDANCE

IV. OCCUPATIONAL AND EMPLOYMENT INFORMATION. Knowledge of trades and professions, vocational training facilities, the employment situation and prospects.

V. PERSONAL GUIDANCE. Collection of information prior to interview, interviews, conclusions drawn from personal examination.

VI. COLLECTIVE GUIDANCE.

VII. FOLLOW-UP.

134 pages PRICE: $1 ; 6s.

International Labour Office, Geneva

THE JOURNAL OF SOCIAL ISSUES

Quarterly Publication of
The Society for the Psychological Study of Social Issues
A Division of the American Psychological Association

CURRENT NUMBER:

Vol. X, No. 4 Cross-National Research: A Case Study. Discussion of the results and experience of the Organization for Comparative Social Research, with articles by V. Aubert, H. C. J. Duijker, B. R. Fisher, H. Hyman, J. Israel, E. Jacobson, D. Katz, S. Rokkan, R. Rommetveit, and S. Schachter.

Supplement Series No. 8. Cultural Discontinuities and Personality Transformation (Kurt Lewin Memorial Lecture by Margaret Mead).

The Journal brings research in social psychology and the social sciences to bear on social practice. Each number is devoted to a single topic.

Yearly subscription: $4.00; Single Copies, $1.25; Supplement Series, $0.50 each

Order from:

ASSOCIATION PRESS

291 Broadway, New York 7, New York, U.S.A.

DOCUMENTATION ÉCONOMIQUE

founded 1934
by the Association de documentation économique et sociale

This journal, suspended in 1939, resumed publication in 1947 under the imprint of the Association de documentation économique et sociale (ADES) and the Institut national de la statistique et des études économiques (INSEE), Direction de la conjoncture et des études économiques.

Contains abstracts from about 180 journals selected from the most important in the economics field in France and abroad. The abstracts are objective, non-critical and are presented according to the decimal classification system used by INSEE. The form and size of each analysis have been specially studied to allow readers using international filing cards to cut them out, gum them on the cards and file them.

Publishers are invited to send review copies of economics publications (including books) for abstracting to:

DOCUMENTATION ÉCONOMIQUE, 29, quai Branly, PARIS-7e.

For Sale and Subscriptions: Presses universitaires de France, 108, boulevard Saint-Germain, Paris-6e. Tél.: Danton 48-64. C.C.P. 392-33.

Subscriptions: One year (five numbers)
France and French Union, 1,700 fr.
Abroad, 1,900 fr.

Each Number:
400 fr.

Internationales Jahrbuch für Geschichtsunterricht

In diesem Jahrbuch berichten Geschichtslehrer aller Länder über ihre Versuche, Reformen und Lehrpläne für einen neuzeitlichen Geschichtsunterricht. Neben Abhandlungen und Aufsätzen über aktuelle Fragen des Geschichtsunterrichts in Deutschland, Europa und Übersee werden ausführliche Berichte über internationale Geschichtslehrertagungen und eingehende Referate über deutsche und ausländische Geschichtslehrbücher veröffentlicht. Prospekt mit Inhaltsverzeichnis steht zur Verfügung. Band II (1953), 391 Seiten Grossformat, in Kartonumschlag DM 3,60

Band III (1954) erschienen im Sommer DM 3,80

Bezug durch jede Buchhandlung.

Verlag Albert Limbach - Braunschweig - Hutfiltern 8

CAHIERS INTERNATIONAUX de SOCIOLOGIE

PUBLICATION DIRIGÉE PAR GEORGES GURVITCH

JUILLET-DÉCEMBRE 1954

Secrétaire de la rédaction : Georges BALANDIER

Paul MUS. Le colonialisme devant les faits.
Georges BALANDIER. Sociologie de la colonisation et relations entre sociétés globales.
François BOURRICAUD. Quelques caractères originaux d'une culture métisse Amérique latino-indienne.
Paul MERCIER. Aspects des problèmes de stratification sociale dans l'Ouest africain.
Henri JANNE. Finalité consciente et libre arbitre en sociologie.
Georges DUVEAU. Utopie et planification.
Roger BASTIDE. Sociologie et littérature comparée.
Edgar MORIN Préliminaires à une sociologie du cinéma.

Études critiques. Comptes rendus.

Un volume in-8° coquille : **400 francs.**

PRESSES UNIVERSITAIRES DE FRANCE
108, boulevard Saint-Germain — Paris-6e

PAKISTAN HORIZON

Published quarterly by the Pakistan Institute of International Affairs, Karachi-4.

Contents of the December 1954 Issue:

Looking at Asia from Japan	K. Sarwar Hasan
The Situation in Indo-China	Phan Quang Dan
Politics in Syria	F. Kardosh
The New China Scene	Begum Husain Malik
The Diplomacy of the non-Communist World	Khalid Bin Sayeed
Land Reform in Middle East-II	A. T. Chaudhri

Book Reviews & Documents

Annual Subscription: $2.40

BOLETÍN DEL INSTITUTO DE DERECHO COMPARADO DE MÉXICO

Órgano del Instituto de Derecho Comparado de la Universidad Nacional Autónoma de México

Publica tres números al año: enero-abril; mayo-agosto y septiembre-diciembre.
DOCTRINA. — LEGISLACIÓN (nacional y extranjera). — TEXTOS Y DOCUMENTOS LEGISLATIVOS de los distintos países, principalmente de Hispanoamérica. — REVISTA DE REVISTAS (extractos de artículos aparecidos en revistas jurídicas del país y del extranjero). — INFORMACIÓN (congresos, conferencias y reuniones nacionales e internacionales).
Suscripciones a: Instituto de Derecho Comparado, Ciudad Universitaria, Torre de Humanidades, 3.er piso, villa A. Obregón 20, MÉXICO D.F.
Precio de la suscripción anual: $4.

REVISTA DEL INSTITUTO DE SOCIOLOGÍA BOLIVIANA

Published once a year, containing about two hundred pages, containing material on the following subjects:

Section I. BOLIVIAN SOCIETY OF SOCIOLOGY. Contributions by members on doctrinal questions.

Section II. PILOT FILE CARDS. Doctrine and bibliography, useful as a guide to students on the investigation of certain monographic subjects.

Section III. ROUND TABLE. Information on research and debate on theorical and practical problems.

Section IV. INTERNAL REGIME. Regulations, work reports and chronicles.

Readers interested in the magazine may order it from the Institute.

Post Office Box 215, Sucre, Bolivia.

Price of single copy: Bs.400, including registered postage by ordinary mail.

The Colonial Review

Annual subscription: 5/-
Single copy: 1/3
Send subscriptions to:
The Secretary,
Department of Education
in Tropical Areas,
University of London
Institute of Education,
London, W.C.1.

This quarterly, published by the University of London Institute of Education, records trends of thought and developments in various fields, especially those of politics, administration, economics, sociology, education and social services, in British, Belgian, Dutch, French and Portuguese Oversea Territories. In addition to articles and book reviews, the *Colonial Review* provides short notices on articles appearing in a wide range of general and specialist journals and on the reports and publications of governments and agencies.

THE BRITISH JOURNAL OF SOCIOLOGY

VOL. V, No. 4 — DECEMBER 1954

CONTENTS

American Criminology Impressions of a European Criminologist — Hermann Mannheim
Social Attitudes to the Problems of Illegitimacy — I. Pinchbeck
Approaches to Conflict in American Industrial Sociology — Harold L. Sheppard
Some Recent Work on Race Relations. A Critique — Maurice Freedman
The Social Background of a West African Student Population I — Gustav Jahoda
The Criminal's Responsibility: A Study in Concepts — D. H. Stott
The Criminal's Responsibility: A Comment by — Anthony Flew
Social Prestige and Social Class — Barbara Wootton

Published Quarterly, 30s. per annum; single copies, 10s. net, post free.

ROUTLEDGE AND KEGAN PAUL
68-74 Carter Lane, London E.C.4

THE CONSERVATIVE MONTHLY

Read by People of All Parties in Many Lands

THE NATIONAL AND ENGLISH REVIEW

Published Monthly — Two shillings

Make sure of your copy each month by placing an order with your newsagent

CUT OUT THIS ADVERTISEMENT AND HAND TO YOUR NEWSAGENT

Please supply me each month with: THE NATIONAL AND ENGLISH REVIEW

Name_____

Address _____

_____

_____

The National and English Review (Periodical Publications Ltd.). 2 Breams Buildings, London, E.C.4, England.

TRAVAIL SOCIAL

La *Fédération française des travailleurs sociaux*, lieu de rencontre de leurs nombreuses associations professionnelles, outre ses diverses activités d'études et d'action, fait paraître une revue qui se trouve donc être l'expression de l'ensemble des travailleurs sociaux et reflète ainsi leur vie et leurs préoccupations, leurs réalisations et leurs espoirs.

Au sommaire du 2e trimestre 1954 :

Nécessité des conflits, par le Dr J.-A. Huet.

La moralité publique et le problème des conflits, par le professeur agrégé H. Baruk.

Attitude du travailleur social dans les conflits sociaux.

Les techniques du travail social, par M. Th. Vieillot.

La formation des travailleurs sociaux.

L'action de la commission féminine du Comité national de défense contre l'alcoolisme, par F. Machtou.

Au sommaire du 3e trimestre 1954 :

Synthèse du cycle 1953-1954 sur la moralité publique, par le professeur Delore.

Réunion régionale de la Fédération chez le Dr Préaut, fondateur-directeur du hameau-école de l'Ile-de-France, à Longueil-Annel, Oise.

L'administration et les usagers, par G. de Latour.

Les techniques du travail social, par M. Th. Vieillot.

Les activités de la Fédération.

Action syndicale chez les assistantes sociales, par A. M. Depret.

Tribune étrangère, par Yv. Turpin.

Chronique rurale.

Notes.

TRAVAIL SOCIAL

REVUE DE LA FÉDÉRATION FRANÇAISE DES TRAVAILLEURS SOCIAUX

3, rue de Stockholm, Paris-8e. Tél. : LABorde 09-86. C.C.P. : 8482-12 Paris.

Un numéro : 250 fr. *Abonnement :* France 1.000 fr. ; étranger 1.500 fr.

RURAL SOCIOLOGY

OFFICIAL JOURNAL OF THE RURAL SOCIOLOGICAL SOCIETY

PUBLISHED AT THE UNIVERSITY OF KENTUCKY LEXINGTON, KENTUCKY

CURRENT ISSUE
VOL. 19 DECEMBER 1954 No. 4

CONTENTS

Land Reform in a Modern World, NATHAN L. WHETTEN
Prospects for Rural Health Care, JOHN R. MCGIBONY and HELEN L. JOHNSTON
Cultural Characteristics and Acceptance of Practices, JAMES A. DUNCAN and BURTON W. KREITLOW
Geographical Position and Mormon Behavior, THOMAS F. O'DEA
Informal Participation of Formal Participants, EMORY J. BROWN
Rural Neighborhood Concept, BRUCE L. MELVIN
Research Notes Applied Sociology Notes
Book Reviews Bulletin Reviews
News Notes and Announcements

Membership in the Rural Sociological Society, including subscription to the journal, is $5 for active members and $2.75 for students, in any country. The journal subscription rate to non-members, libraries, and institutions is $4.75 per year to the United States and Canada; $5 per year to all other countries, postage paid.

Editor: Harold Hoffsommer.

Send subscription orders and manuscripts to:
A. Lee Coleman, Managing Editor
Rural Sociology
c/o University of Kentucky
Lexington, Kentucky.

Send membership applications and dues to:
Ward W. Bauder, Secretary-Treasurer
The Rural Sociological Society
c/o University of Illinois
Urbana, Ill.

ZEITSCHRIFT FÜR DIE GESAMTE STAATSWISSENSCHAFT

Herausgegeben von
Professor Dr. FRANZ BÖHM, Frankfurt/M.; Professor Dr. WILHELM GREWE, Freiburg/Br.; Professor Dr. WALTHER HOFFMANN, Münster; Professor Dr. HEINZ SAUERMANN, Frankfurt/M.

Die Zeitschrift für die gesamte Staatswissenschaft führt eine alte wissenschaftliche Tradition weiter.
Das letzte Heft, 110. Band Heft 2, enthält die folgenden Abhandlungen und Berichte:
Dr. WALTER WEDDIGEN, Professor, Nürnberg: Der Unternehmer in der Volkswirtschaft; Dr. MICHAEL KRÖLL, Professor, Wien: Der Zirkulartausch. Eine Kreislaufanalyse; Dr. HANS DOMBOIS, Staatsanwalt a. D., Hemer Krs. Iserlohn: Mensch und Sache. Zum Problem des Eigentums. Dr. FRIEDRICH GIESE, Professor, Frankfurt/M.-Mainz: Die Bundeskompetenz zur Regelung des Wasserhaushaltswesens; Dr. STEN S. NILSON, Dozent, Oslo: Wahlsoziologische Probleme des Nationalsozialismus; Dr. W. O. HENDERSON, Lecturer, Manchester/England: England und die Entwicklung der Eisenindustrie und des Transportwesens in Frankreich 1750-1850.

Die Zeitschrift erscheint bandweise. Ein Band umfasst 4 Hefte zu je etwa 190 Seiten. Preis des Heftes im Abonnement: DM 18.-; Einzelpreis: DM 20.-

J. C. B. MOHR (PAUL SIEBECK) TÜBINGEN

WILHELMSTRASSE 18

The German Economic Review
distributed all over the world

WIRTSCHAFTSDIENST

Monthly Review published by
HAMBURGISCHES WELT-WIRTSCHAFTS-ARCHIV
with English edition for readers abroad

In open discussion the readers will get acquainted with Germany's economic problems. Pertinent reports will inform them of the situation and the development of the various economic branches.

Subscription fee: DM.10.- quarterly incl. English edition

Ask for sample copies

VERLAG WELTARCHIV GMBH ● HAMBURG 36 ●
Poststrasse 11, GERMANY

Dinamica Social

DINAMICA SOCIAL, publication du Centro de Estudios Económico-Sociales (Centre d'études économiques et sociales), paraît mensuellement en espagnol, en italien et en français à Buenos Aires, calle Libertad 1050.

DINAMICA SOCIAL a été fondée par un groupe de spécialistes américains et européens et se propose de répandre, de l'un et de l'autre côté de l'Atlantique, les principes d'une « troisième position » en face de tous les totalitarismes.

Dans le même Centro de Estudios Económico-Sociales se publient à la E.D.A. (Editorial de Autores) des livres et des cahiers traitant de différentes questions sociales ou politiques d'actualité.

RIVISTA INTERNAZIONALE

DI SCIENZE SOCIALI

FONDATA NEL 1893 E PUBBLICATA A CURA
DELL'UNIVERSITA CATTOLICA DEL SACRO CUORE

Esce ogni due mesi e pubblica articoli inediti di studiosi italiani e stranieri in materia di economia, politica economica e finanziaria, sociologia e scienze politiche. Informa i lettori sullo sviluppo internazionale delle scienze sociali con note, rassegne e analisi d'opere.

Abbonamento annuo per l'estero L.3.500 ovvero $5 oppure l'equivalente in valuta estera

Redazione e Amministrazione: MILANO, Piazza S. Ambrogio, 9

THE EASTERN ANTHROPOLOGIST

A QUARTERLY RECORD
OF ETHNOGRAPHY AND FOLK CULTURE

Just issued:

Vol. VIII, No. 1. Contributions to this issue include articles by G. S. Bhatt (on the Chamars of Lucknow); E. Eames (on patterns of Urban Migration in North Indian village); R. Prakash Rao (on the Lambadas of Hyderabad); Notes and comments; Research views and News and Reviews.
Due for distribution in February 1955: Vol. VIII, No. 2. Contributors to this issue include: D. N. Majumdar, D. K. Sen, Surama Das Gupta, B. N. Puri, A. K. Saran.

Price per volume: £1.

Available from: The Secretary,
The Eastern Anthropologist,
Anthropology Laboratory, Lucknow University, Lucknow, India.

VOUS INTÉRESSEZ-VOUS A L'AVENIR DU MONDE ?

Votre paix aussi est en jeu dans les événements internationaux. Si vous voulez avoir une documentation complète et objective sur la politique étrangère, lisez notre hebdomadaire

RELAZIONI INTERNAZIONALI

24 pages : 100 lires
Istituto per gli Studi di Politica Internazionale
Via Clerici 5, MILANO

Abonnements pour la France :
8.000 lires ou 4.500 francs
chez le Dr A. Baroni
6, rue Christophe-Colomb, PARIS-8e

RELAZIONI INTERNAZIONALI

présente une riche documentation sur la politique italienne et internationale

MIDDLE EASTERN AFFAIRS

The only American monthly devoted to the Middle East

ANSWERS QUESTIONS THAT AFFECT WORLD PEACE :

Iranian oil and the international consortium
German penetration
British evacuation of Suez and regional security
Turkey-Pakistan alignment
Turkey-Greece-Yugoslavia alignment
Inter-Arab relations
Peace between Israel and the Arab states
Saudi Arabian oil and the American concessions
North Africa and France

Articles, Analyses, Comments, Important Documents on
POLITICS — ECONOMICS — EDUCATION — FINANCE — CULTURE

A basic understanding of a vast and troubled region is to be found in
MIDDLE EASTERN AFFAIRS

Published by Council for Middle Eastern Affairs
11 West 42nd Street, New York 36, N.Y.

Subscription: $3.00 a year
Foreign: $3.50 a year

Bound volumes: $6.00 each
I (1950); II (1951); III (1952); IV (1953); V (1954)

The Bruges Quarterly

PUBLISHED BY THE COLLEGE OF EUROPE

makes known the work of the College.

Contributions are drawn exclusively from members of the College: professors, students and former students. They are of interest not only to specialists on European questions, statesmen, leaders in economic and social life, but also to all those who are concerned with the future of Europe, and their number increases every day.

Europe is being made slowly. In the *Bruges Quarterly* the different aspects of European integration are analysed. Articles are devoted to all the urgent questions which Europeans must consider today and to the plans which must be made for the immediate or the remote future.

These articles are published either in English or in French, the official languages of the College. Each article is followed by a résumé in the other language, which is also, frequently, a brief commentary.

Rates for one year: Belgium: 180 B.fr.
Elsewhere: 200 B.fr.

Kindly make all payments via postal money order 194611 "EDITIONS DE TEMPEL", 37 Tempelhof, Bruges, Belgium.

Please mention: "Subscription to BRUGES QUARTERLY".

European History — The History of Political and Social Doctrines — Sociology — Geography — Administrative Sciences — Economics — International, Comparative and Constitutional Law — European Institutions.

SONDAGES

REVUE FRANÇAISE DE L'OPINION PUBLIQUE

20, rue d'Aumale, PARIS-9e — Tél. : TRI. 08-38

Présente tous les trois mois les résultats d'enquêtes conduites par l'*Institut français d'opinion publique.*

Au sommaire de quelques numéros :

L'enseignement en France (1950).
L'influence de la presse quotidienne et l'opinion des lecteurs selon leur journal (1952).
La réforme électorale (1951).
Paris, une enquête psycho-sociale (1951).
Le catholicisme en France (1952).
Les électeurs des différents partis (1952).
Une enquête sur la Communauté européenne de défense (1953).
Les États-Unis, les Américains et la France, 1945-1953 (1953).
Bibliographie des travaux et articles parus en Europe jusqu'en 1953, sur l'étude de l'opinion publique (1953).
La motorisation de l'agriculture en France (1953).
La propagande politique (1954).

PRIX DE VENTE ET D'ABONNEMENT

France et Union française :		*Étranger :*	
Le numéro	450 fr.	Le numéro	450 fr.
Abonnement d'un an .... (4 numéros franco)	1.500 fr.	Abonnement d'un an .... (4 numéros franco)	1.500 fr.

The best way to KEEP UP WITH ANTHROPOLOGY... is to read the new and enlarged

AMERICAN ANTHROPOLOGIST

You are invited to join the American Anthropological Association For the annual dues of $8.50 (institutions $9) you get

- 6 issues of the *American Anthropologist*, at least 160 pages each
- 4 issues of the *Bulletin* of the Association
- *Memoirs* as issued (at least 2 are guaranteed for 1955—probably more)
- The privilege of buying many books at large discounts—many members save more than their annual dues!

Write to William S. Godfrey, Jr., Executive Secretary, American Anthropological Association, Logan Museum, Beloit College, Beloit, Wisconsin, U.S.A. Enclose check for $8.50 to begin membership at once.

PARAIT TOUS LES TROIS MOIS

UNIVERSITÉ LIBRE DE BRUXELLES
INSTITUT DE SOCIOLOGIE SOLVAY

Revue
de
l'Institut de sociologie

PUBLIÉE AVEC LE CONCOURS
DE LA FONDATION UNIVERSITAIRE DE BELGIQUE

La *Revue de l'Institut de sociologie* paraît depuis 1920, époque à laquelle elle remplaça le *Bulletin de l'Institut de sociologie Solvay* (Archives sociologiques) qu'éditait l'institut depuis 1910.

La *Revue de l'Institut de sociologie* est ouverte à toutes les disciplines ressortissant aux sciences sociales. Elle publie annuellement 4 fascicules de 200 pages environ, contenant :

Des articles de fond

Une chronique du mouvement scientifique
Comptes rendus d'ouvrages récents
Bibliographie

Un « Carnet sociologique »
Informations
Notes d'observations sociologiques

ABONNEMENT ANNUEL : Belgique : 400 fr. belges.
Étranger : 450 fr. belges.

LE NUMÉRO : 125 fr. belges.

ÉDITIONS DE LA LIBRAIRIE ENCYCLOPÉDIQUE
7, rue du Luxembourg, Bruxelles

EIN WEITES UND AKTUELLES AUFGABENFELD

Das Schaffen und die Erkenntnisse der deutschen Raumforschung dokumentieren sich in der im 11. Jahrgang vierteljährlich erscheinenden Zeitschrift.

RAUMFORSCHUNG UND RAUMORDNUNG

die vom Institut für Raumforschung Bonn und der Akademie für Raumforschung und Landesplanung gemeinsam herausgegeben wird. Die Herausgeber wollen mit den Argumenten der Raumforschung und Landesplanung an der Diskussion über die regionale Verteilung der Bevölkerung, die Nutzung des Bodens, die Entwicklung der Industrie, die Gestaltung des Verkehrs und der Versorgungseinrichtungen sowie über all die übrigen Planungen teilnehmen, die auf die räumliche Ordnung Einfluss nehmen können. In Aufsätzen und Beiträgen wird versucht, Wesen, Arbeitsmethoden, Aufgaben und Ziele der Raumforschung in Deutschland und im Ausland zu klären. Berichte aus der praktischen Landesplanung stellen die Verbindung zum tätigen Leben her. Auszüge aus der in- und ausländischen Fachpresse vermitteln den Lesern Forschungs- und Untersuchungsergebnisse aus aller Welt. Dem Planungsrecht wird besondere Beachtung geschenkt. Institut und Akademie wollen dabei mit wissenschaftlichem Ernst und Unabhängigkeit die brennenden Fragen der Raumordnung und Landesplanung von einem breiten Forum der Öffentlichkeit erörtern.

CARL HEYMANNS VERLAG KG
Köln, Gereonstrasse 18-32

KYKLOS

INTERNATIONAL REVIEW FOR SOCIAL SCIENCES

Vol. VII, 1954, Fasc. 3

Economics and the Behavioral Sciences	K. William Kapp
Limitational Factors in Population Theory: A Note	Joseph J. Spengler
Toward a General Definition of Rational Action	Sidney Schœffler
The Wealth of Nations with a Grain of Salt	G. Sotiroff
Spiethoff's Views on the Business Cycle	Gardner Ackley
Whitin's Inventory Theory	Moses Abramovitz

Book Reviews—Titles of New Books

All articles are followed by a summary in English, French and German. Published quarterly. New subscription rate: 26 S.fr. ($ 6.—).

Les articles sont suivis de résumés en français, anglais et allemand. Revue trimestrielle. Nouveau prix de l'abonnement : 26 fr. s. ($ 6.—).

Order from your bookstore or the publisher : Kyklos-Verlag

Pour les abonnements, s'adresser aux libraires ou à l'éditeur : Seevogelstrasse 140, Basel (Switzerland/Suisse)

PARLIAMENTARY GOVERNMENT

A study box produced by the British Council in association with the Hansard Society. £3.3s. (carriage 2s.).

This study box has been specially prepared for teachers, instructors, and discussion group leaders, and contains:

Guide for the instructor.

Wall chart 'The Structure of Government' (30 in. by 40 in.) prepared by the British Council and the Hansard Society.

Wall chart 'The House of Commons' (30 in. by 40 in.) prepared by Pictorial Charts Unit.

Filmstrip and notes. 'British Parliamentary Government' (47 frames).

Filmstrip and notes. 'The Story of an Act' (25 frames).

Parliamentary Government. By Sydney D. Bailey. (An illustrated British Council Study Booklet.)

Parliaments and Politics. By K. C. Wheare. (Bureau of Current Affairs.)

Our Parliament. By Strathearn Gordon.

The British Party System. A Symposium edited by Sydney D. Bailey.

Papers on Parliament.

Questions on Parliament and *Answers to 'Questions on Parliament'.* By K. Gibberd.

A Day in Parliament. Sample material consisting of the official 'Votes and Proceedings', *Hansard* for the House of Commons and the House of Lords, copies of the following newspapers reporting the debates: *The Times, Daily Telegraph, Daily Mail, Daily Express, News Chronicle, Daily Herald, Daily Graphic and Sketch, Daily Mirror,* and *Daily Worker,* and a dramatized script based on *Hansard.*

Sample propaganda material (posters, pamphlets, leaflets, etc.) issued by the Conservative, Liberal, and Labour Parties.

Sample Poll Card and Canvass Card.

HANSARD SOCIETY, 39 MILLBANK, S.W. 1

COLD WAR TRAGEDY

By

JAMES P. WARBURG

Financier—Scholar

Author of

The United States in a Changing World

A Feature of

THE WESTERN POLITICAL QUARTERLY

Approximately 900 pages Four dollars per volume
($5.00 abroad)

Send orders to the Editor, Professor F. B. Schick

University of Utah

Salt Lake City, Utah, U.S.A.

TRANSACTIONS
of the
SECOND
WORLD CONGRESS
of
SOCIOLOGY

(Liège, 1953)

VOLUME I (published November 1954), 250 pages, contains an introduction by Professor Robert C. Angell, twenty-five reports on *Current Sociological Research* in twelve different countries, thirteen papers on the *Training, Professional Activities and Responsibilities of Sociologists*, and reports of the Congress discussions.

VOLUME II (published December 1954), 420 pages, contains an introductory paper and report of the Congress discussions by Professor D. V. Glass, and forty-six papers, on *Social Stratification and Social Mobility*, ranging over national and regional surveys of stratification, comparative studies of professions, social mobility, characteristics of different social strata, and theoretical and methodological studies.

Published by the International Sociological Association, 13 Endsleigh Street, London, W.C.1.

Published Price 25/- each volume.

Price to members of affiliated associations 21/- (cloth) each volume.
15/- (paper)

World Politics

VOL. VII, No. 2 JANUARY 1954

CONTENTS

Indian Foreign Policy: An Interpretation of Attitudes — TAYA ZINKIN
American Policy-making and the North Korean Aggression — ALEXANDER L. GEORGE
Trends in Aerial Defense — ASHER LEE
Conditions and Prospects for Economic Growth in Communist China (Part III) — ALEXANDER ECKSTEIN

REVIEW ARTICLES

Foreign Policy: The Conservative School — HANS J. MORGENTHAU
Psychology and Politics: The Freudian Connection — PHILIP RIEFF
The Difficult Art of Generalization — BERT F. HOSELITZ
The Administration of Foreign Affairs in the United States — JAMES L. MCCAMY
The Statistical Analysis of Anglo-American Economic Development — DAVID S. LANDES

RESEARCH NOTE

A Query About Assumptions on International Relations — GERHART NIEMEYER

CURRENT SOCIOLOGY

A bilingual quarterly

International Bibliography of Sociology. A handy instrument for the exchange of scientific information between sociologists. Prepared by the International Sociological Association with the support of the Co-ordinating Committee on Documentation in the Social Sciences.

Annual subscription: $3.50; 18/6; 900 fr.
Single copy: $1.00; 6/-; 300 fr.

UNESCO

Obtainable through Bookshops or direct from the Unesco National Distributor (see List)

POPULATION STUDIES

A Journal
of Demography
Edited by
D. V. GLASS
and E. GREBENIK

Contents for VOL. VIII, No. 3 MARCH 1955

Some Aspects of Mating and Fertility in the West Indies	G. W. ROBERTS
John Maynard Keynes' Theories of Population and the Concept of "Optimum"	William PETERSEN
Early Childhood in Broken Families	Griselda ROWNTREE
Marshall on the Population Question (Part I)	J. J. SPENGLER
The quality of response in census-taking	B. BENJAMIN

Subscription price per volume of 3 parts 35/- net, post free (or American currency $5.75).

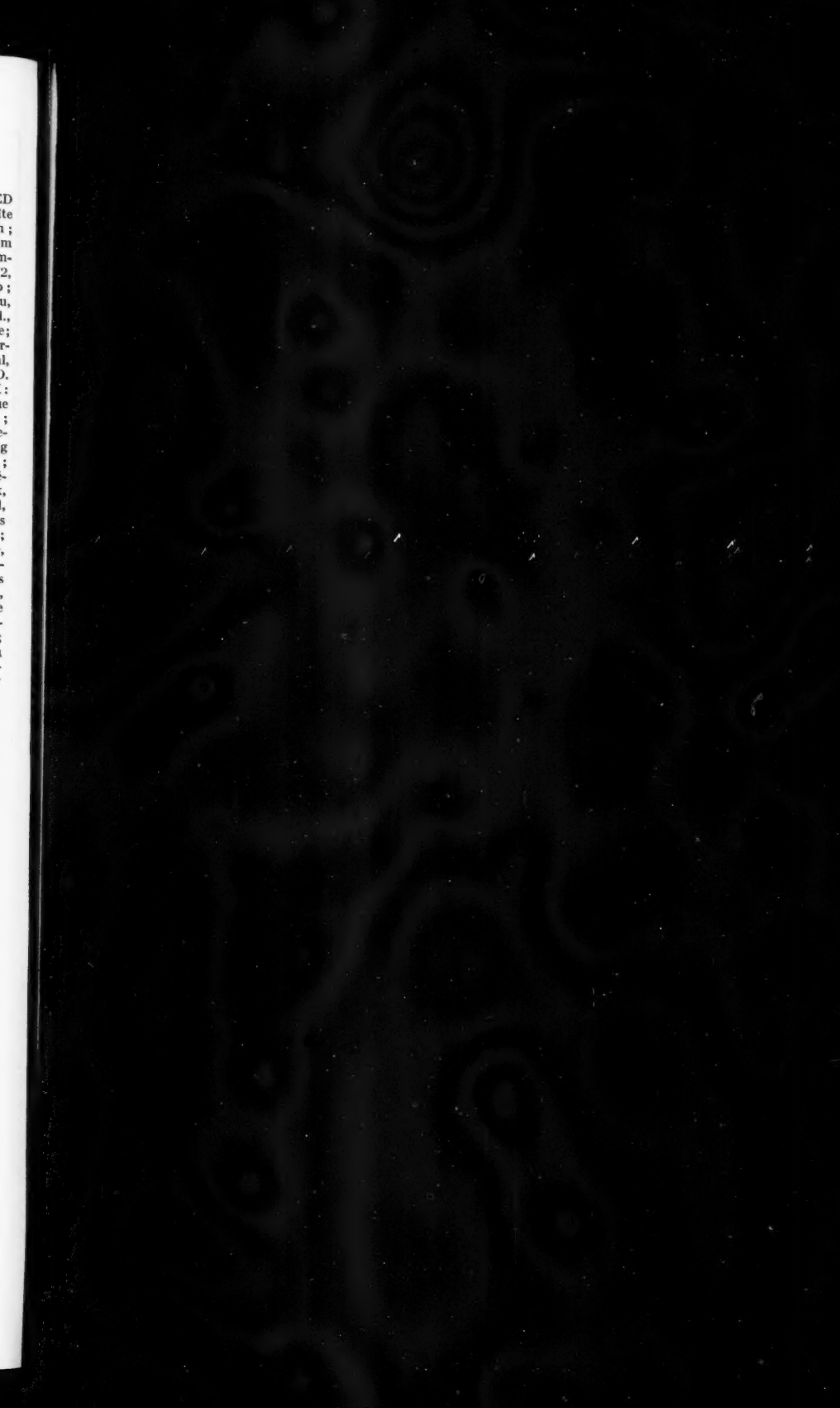
Single parts 15/- each plus postage (American $2.50, post free).

Published by the Population Investigation Committee, at the London School of Economics and Political Science, 15 Houghton Street, London, W.C.2.

UNESCO PUBLICATIONS: NATIONAL DISTRIBUTORS

ARGENTINA : Editorial Sudamericana, S. A., Alsina 500, Buenos Aires ; ASSOCIATED STATES OF CAMBODIA, LAOS AND VIET-NAM : Librairie Nouvelle Albert Portail, Boite Postale 283, Saigon ; *Sub-depot :* Librairie Albert Portail, 14, avenue Boulloche, Phnom-Penh ; AUSTRALIA : Oxford University Press, 346 Little Collins St., Melbourne ; AUSTRIA : Wilhelm Frick Verlag, 27 Graben, Vienna I ; BELGIUM : Librairie Encyclopédique, 7, rue du Luxembourg, Brussels IV ; BOLIVIA : Libreria Selecciones, Avenida Camacho 369, Casilla 972, La Paz ; BRAZIL : Livraria Agir Editora, rua México 98-B, Caixa postal 3291, Rio de Janeiro ; CANADA : University of Toronto Press, Toronto ; Periodica Inc., 5112 avenue Papineau, Montreal 34 ; CEYLON : Lake House Bookshop, The Associated Newspapers of Ceylon Ltd., P. O. Box 244, Colombo I; CHILE : Librería Lope de Vega, Calle Estado 54, Santiago de Chile; COLOMBIA : Emilio Royo Martin, Carrera 9a, No. 1791, Bogota ; COSTA RICA : Trejos Hermanos, Apartado 1313, San Jose ; CUBA : Unesco Centro Regional en el Hemisfero Occidental, Calle 5 No. 306 Vedado, Apartado 1358, Havana ; CYPRUS : M. E. Constantinides, P. O. Box 473, Nicosia ; CZECHOSLOVAKIA : Artia Ltd., 30 Ve smeckách, Prague, 2 ; DENMARK : Einar Munksgaard Ltd., 6 Norregade, Copenhagen K ; ECUADOR : Libreria Cientifica, Luque 233, Casilla 362, Guayaquil ; EGYPT : La Renaissance d'Égypte, 9 Adly Pasha Street, Cairo ; ETHIOPIA : International Press Agency, P. O. Box 120, Addis Ababa ; FINLAND : Akateeminen Kirjakauppa, 2 Keskuskatu, Helsinki ; FORMOSA : The World Book Co. Ltd., 99 Chung King Rd., Section I, Taipeh ; FRANCE : Unesco Bookshop, 19, avenue Kléber, Paris-16e ; GERMANY : Unesco Vertrieb für Deutschland, R. Oldenbourg, Munich ; GREECE : Eleftheroudakis, Librairie internationale, Athens ; HAITI : Librairie ' A la Caravelle ', 36, rue Roux, Boite postale III-B, Port-au-Prince ; HONG KONG : Swindon Book Co., 25 Nathan Road, Kowloon ; HUNGARY : Kultura, P. O. B. 149, Budapest 62 ; INDIA : Orient Longmans Ltd., Indian Mercantile Chamber, Nicol Road, Bombay ; 17 Chittaranjan Ave., Calcutta ; 36-A Mount Road, Madras ; *Sub-depots :* Oxford Book and Stationery Co., Scindia House, New Delhi ; Rajkamal Publications Ltd., Himalaya House, Hornby Road, Bombay I ; INDONESIA : C. G. T. van Dorp and Co., Djalan Nusantara 22, Jakarta ; IRAQ : McKenzie's Bookshop, Baghdad ; ISRAEL : Blumstein's Bookstores, Ltd., 35 Allenby Road, P. O. B. 5154, Tel Aviv ; ITALY : Libreria Commissionaria G. C. Sansoni, via Gino Capponi 26, Casella postale 552, Florence ; JAMAICA : Sangster's Book Room, 99 Harbour Street, Kingston, Knox Educational Services, Spaldings ; JAPAN : Maruzen Co. Inc., 6 Tori-Nichome, Nihonbashi, Tokyo ; JORDAN : Joseph I. Bahous and Co., Dar-ul-Kutub, Salt Road, Amman ; KOREA : Korean National Commission for Unesco, Ministry of Education, Seoul ; LEBANON : Librairie Universelle, Avenue des Français, Beirut ; LIBERIA : J. Momolu Kamara, 69 Front and Gurley Streets, Monrovia ; LUXEMBOURG : Librairie Paul Bruck, 33, Grande-Rue ; MADAGASCAR : La Librairie de Madagascar, Tananarive ; MALAYAN FEDERATION AND SINGAPORE : Peter Chong and Co., P. O. Box 135, Singapore ; MALTA : Sapienza's Library, 26 Kingsway, Valletta ; MEXICO : Difusora de las publicaciones de la Unesco, Artes 31, int. bajos, Mexico, D. F. ; NETHERLANDS : N. V. Martinus Nijhoff, Lange Voorhout 9, The Hague ; NEW ZEALAND : Unesco Publications Centre, 7 De Lacy Street, Dunedin, N.E. 2 ; NIGERIA : C. M. S. Bookshop, P.O. Box 174, Lagos ; NORWAY : A/S Bokhjornet, Stortingsplass 7, Oslo ; PAKISTAN : Ferozsons, 60 The Mall, Lahore. Bunder Road, Karachi, 35 The Mall, Peshawar ; PANAMA : Agencia Internacional de Publicaciones, Apartado 2052, Plaza de Arango No. 3, Panama, R. P. ; PERU : Librería Mejia Baca, Azangaro 722, Lima ; PHILIPPINES : Philippine Education Co., 1104 Castillejos, Quiapo, Manila ; PORTUGAL : Publicaçoes Europa-América, Ltda., Rua das Flores 45, 1o, Lisbon ; PUERTO RICO : Pan-American Book Co., San Juan 12 ; SENEGAL : Librairie ' Tous les Livres ', 30, rue de Thiong, Dakar ; SPAIN : Aguilar, S. A. de Ediciones, Juan Bravo 38, Madrid ; SURINAM : Radhakishun and Co. Ltd., (Book Dept.), Watermolenstraat 36, Paramaribo ; SWEDEN : A/B C.E. Fritzes Kungl., Hovbokhandel, Fredsgatan 2, Stockholm 16 ; SWITZERLAND : Librairie Antoine Dousse, Ancienne Librairie de l'Université, Case postale 72, Fribourg ; Europa Verlag, 5 Rämistrasse, Zürich ; *Sub-depot :* Librairie Payot, place Molard, Geneva ; SYRIA : Librairie Universelle, Damascus ; THAILAND : Suksapan Panit, Arkarn 9, Rajdamnern Ave., Bangkok ; TUNISIA : Victor Boukhors, 4, rue Nocard, Tunis ; TURKEY : Librairie Hachette, 469 Istiklal Caddesi, Beyoglu, Istanbul ; UNION OF BURMA : Burma Educational Bookshop, 551-3 Merchant Street, P.O. Box 222, Rangoon ; UNION OF SOUTH AFRICA : Van Schaik's Bookstore (Pty) Ltd., P.O. Box 724, Pretoria ; UNITED KINGDOM AND N. IRELAND : H. M. Stationery Office, P.O. Box 569, London, S.E.1 ; UNITED STATES OF AMERICA : Unesco Publications Service, 475 Fifth Avenue, New York 17, N. Y. ; URUGUAY : Unesco, Centro de Cooperación, Cientifica para América Latina, Bulevar Artigas 1320, Montevideo ; VENEZUELA : Libreria Villegas Venezolana, Madrices a Marrón N. 35, Pasaje Urdaneta, Local B, Caracas ; YUGOSLAVIA : Jugoslovenska Knjiga, Terazije 27/II, Belgrade.

UNESCO BOOK COUPONS

Unesco Book Coupons can be used to purchase all books and periodicals of an educational, scientific or cultural character. For full information please write to: Unesco Coupon Office, 19 avenue Kléber, Paris-16e, France.

Imp. CRÉTÉ, Corbeil-Essonnes (S.-et-O.). — 4567-1-55. — Dépôt légal : 1er trimestre 1955.